# The American Journal of Surgery

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December 1951

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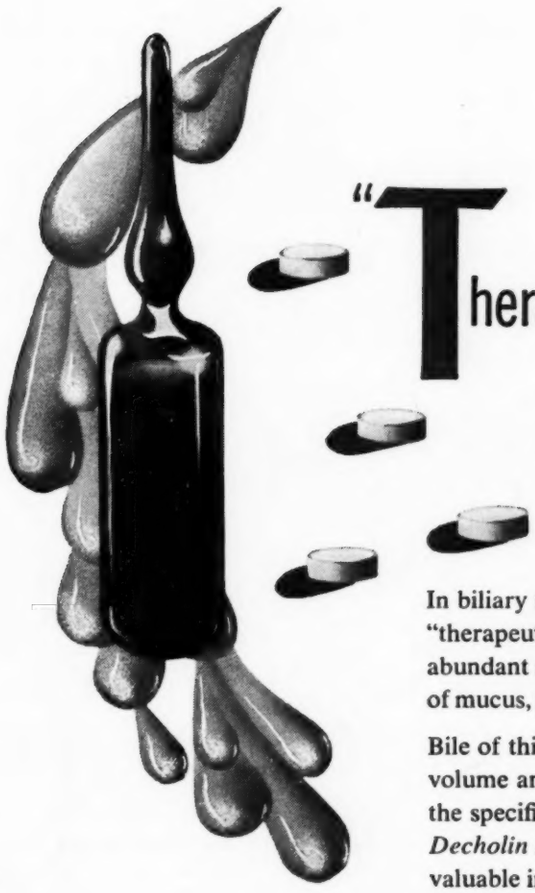

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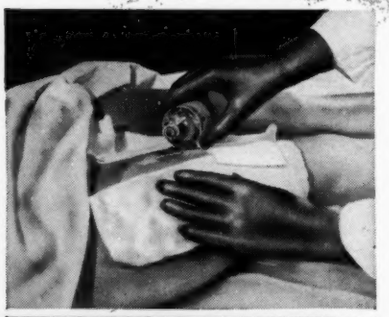

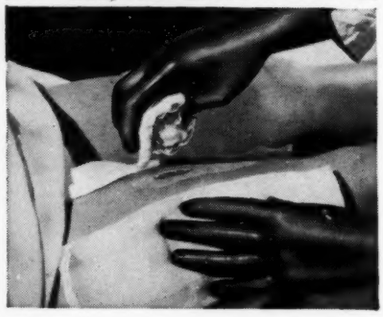

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VOL. LXXXII — *Contents • December, 1951* — NUMBER SIX


## *Editorial*


BLOOD VESSEL BANK FOR THE RECONSTRUCTION AND REPAIR OF BILIARY DUCTS . . . . *A. L. Soresi* 671


## *Original Articles*


MANAGEMENT OF DIVERTICULITIS COLI . . . *Hollis L. Albright and Field C. Leonard* 674

The types of diverticulitis which do and do not require surgery are presented herein. Technic of various operations and treatment of complications are discussed and illustrated with case reports.

CARDIAC ARREST DURING SURGERY . . . . . *Meyer Corff* 683

Causes and treatment of cardiac arrest are discussed as well as the value of promptness and the necessity of having various drugs ready in the operating room.

AGENESIS OF THE VERMIFORM APPENDIX. . . . . *Donald C. Collins* 689

A review of the literature on agenesis of the human vermiform appendix, and three additional case reports added from the author's clinical and postmortem records.

EFFECT OF VARIATION IN LENGTH OF DECOMPRESSION TUBE UPON BOWEL WALL. A CLINICAL AND LABORATORY STUDY . . . . . *Meyer O. Cantor, Earle Acker, Andrew Scharf and Keith Foster* 697

Because there is variability of opinion regarding the length of intestinal tube that would best be used and because of case reports of intussusception due to intubation, the authors made a study of the effect of varying lengths of tube upon the small bowel. It was concluded they should be of such a length that would cause the least interference with the normal physiology of the small bowel. The ideal tube length, as a result of these studies, is given.

ACUTE CHOLECYSTITIS. STUDY OF 140 CASES. . . . . *H. Robert Freund* 703

An analysis of a series of 140 cases of acute cholecystitis, practically none of which were subjected to early surgery. The diagnostic criteria used in unoperated cases are enumerated.

RECTAL SARCOMA AND ANORECTAL MALIGNANT MELANOMA . . . . . *Harry C. Bacon and Michael C. Tavenner* 709

Review of the literature with classification, symptomatology and treatment of rectal sarcoma and anorectal malignant melanoma, with case reports.

RATIONALE OF PROSTATECTOMY . . . . . *Miley B. Wesson* 714

A review with technic and indications for the four recognized methods of prostatectomy. The two fundamental requirements are a sound grounding in anatomy and thorough training in surgical technic.


*Contents Continued on Page 5*

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FURTHER STUDIES OF THE RATE OF HEALING OF HUMAN SKIN MEASURED BY THE ELECTRICAL WOUND POTENTIAL OF EXPERIMENTAL ABRASIONS . . . . . *T. Cunliffe Barnes, J. Karasic and Marie D. Amoroso* 720

In 1945 we published a study of the rate of healing of human skin measured by the electrical wound potential rather than by the naked eye. In the current article the author reports the results of further studies on this subject.

## *Modern Operative Technics*

SPLENORENAL SHUNT FOR PORTAL HYPERTENSION. THORACICO-ABDOMINAL APPROACH. . *Conrad R. Lam* 727

The logical treatment of portal hypertension is the creation of a shunt between the portal system and the vena cava. This may be accomplished by the operation described herein.

## *Streamlined Articles*

CARCINOMA OF THE BREAST. THE DIAGNOSTIC SIGNIFICANCE OF PAIN . . . . . *Louis River, Joseph Silverstein, John Grout, Everett Nicholas, Arne Schairer, Berger Carlson, Roy Tanoue and John Tope* 733

FURTHER STUDIES WITH ULTRAVIOLET BLOOD IRRADIATION THERAPY (KNOTT TECHNIC) IN SEPTIC ABORTIONS . . . . . *E. W. Rebbeck* 736

BREAST BIOPSIES. A STUDY OF OVER 400 CASES . . . . . *Lawrence G. Khedroo, Philip A. Casella and Arthur F. Cipolla* 741

## *Case Reports*

INTRAHEPATIC CHOLANGIOJEJUNOSTOMY WITH PARTIAL HEPATECTOMY. REPORT OF A SUCCESSFUL CASE. . . . . *Kenneth C. Sawyer* 746

Although intrahepatic cholangiojejunostomy is an operative procedure of considerable risk and magnitude, the author reports a successful case.

ACUTE TORSION OF GALLBLADDER . . . . . *Thomas C. Case* 749

A case of acute torsion of the gallbladder with gangrene is described and a brief report is given of another experience with axial rotation of the gallbladder.


*Contents Continued on Page 7*

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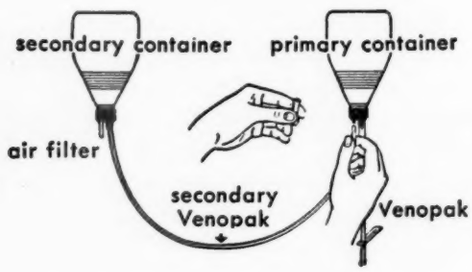

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Reg. U.S. Pat. Off., Nov. 3, 1936

VOL. LXXXII — *Contents • December, 1951* — NUMBER SIX



GIANT CELL TUMOR OF THE ILIUM . . . *William T. Lemmon and T. Burritt Mervine* 754

Report of a case of giant cell tumor of the ilium, with historical review, incidence, sex, age and location, pathology, behavior of osteoclastomas, symptoms and signs, diagnosis and treatment.

ISLET CELL TUMOR OF THE PANCREAS . . . *Foster L. McMillan and John R. Scheibe* 759

Presentation of a case of a single benign islet cell tumor of the pancreas associated with severe hypoglycemia and hyperinsulinism successfully treated surgically.

FAMILIAL MULTIPLE LIPOMATOSIS. . . . . *Frank T. Kurzweg and Rowena Spencer* 762

A report of three cases of familial multiple lipomatosis, with a review of the literature and twenty-four affected families collected.

LUMBAR HERNIA . . . . . *Fedor L. Senger and Miles W. Thomley* 766

A review of lumbar hernia with an unusual and interesting case report.

PAPILLARY CYSTADENOMA OF THE ROUND LIGAMENT IN NUCK'S CANAL . . . . . *Maxwell M. Sayet and William Wickman* 769

Consideration of a rare case of papillary cystadenoma of Nuck's canal.

PERFORATION OF THE SMALL INTESTINE FROM NON-PENETRATING ABDOMINAL TRAUMA . *Harold H. Macumber and Richard D. Shelby* 771

Report of an unusual case of perforation of jejunum found at operation. The trauma in this case was non-penetrating.

## *New Instruments*

GUIDE FOR HIP NAILING . . . . . *Mervyn G. Hardinge* 772

TEMPORARY PROSTHESIS FOR AMPUTATIONS OF THE LOWER EXTREMITY . . . . . *J. E. M. Thomson and Howard Zimmer* 778

ATRAUMATIC MULTI-PURPOSE OBSTETRIC FORCEPS . . . . . *Wilford J. Ratzan* 780

AUTHOR INDEX TO VOLUME LXXXII . . . . . 783

SUBJECT INDEX TO VOLUME LXXXII . . . . . 785

*Advertising Index on 3rd Cover*


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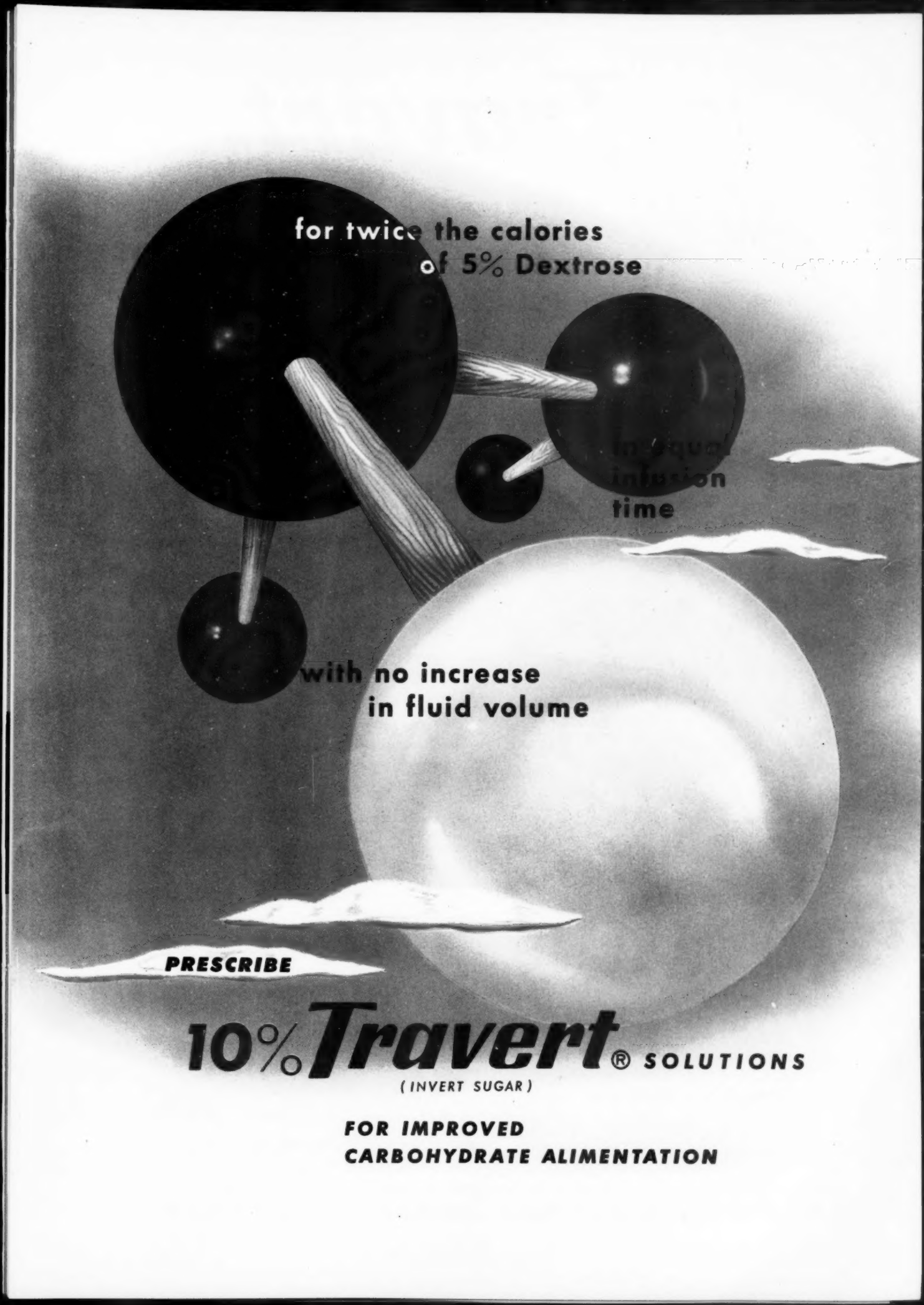
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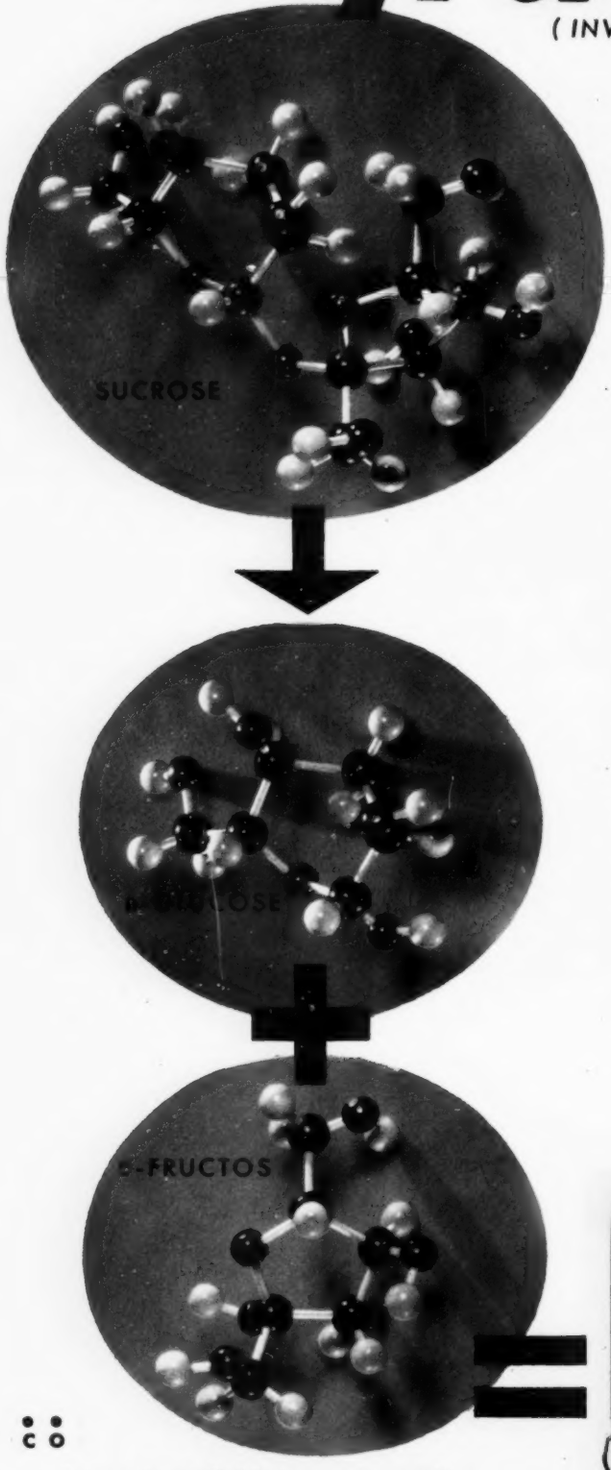


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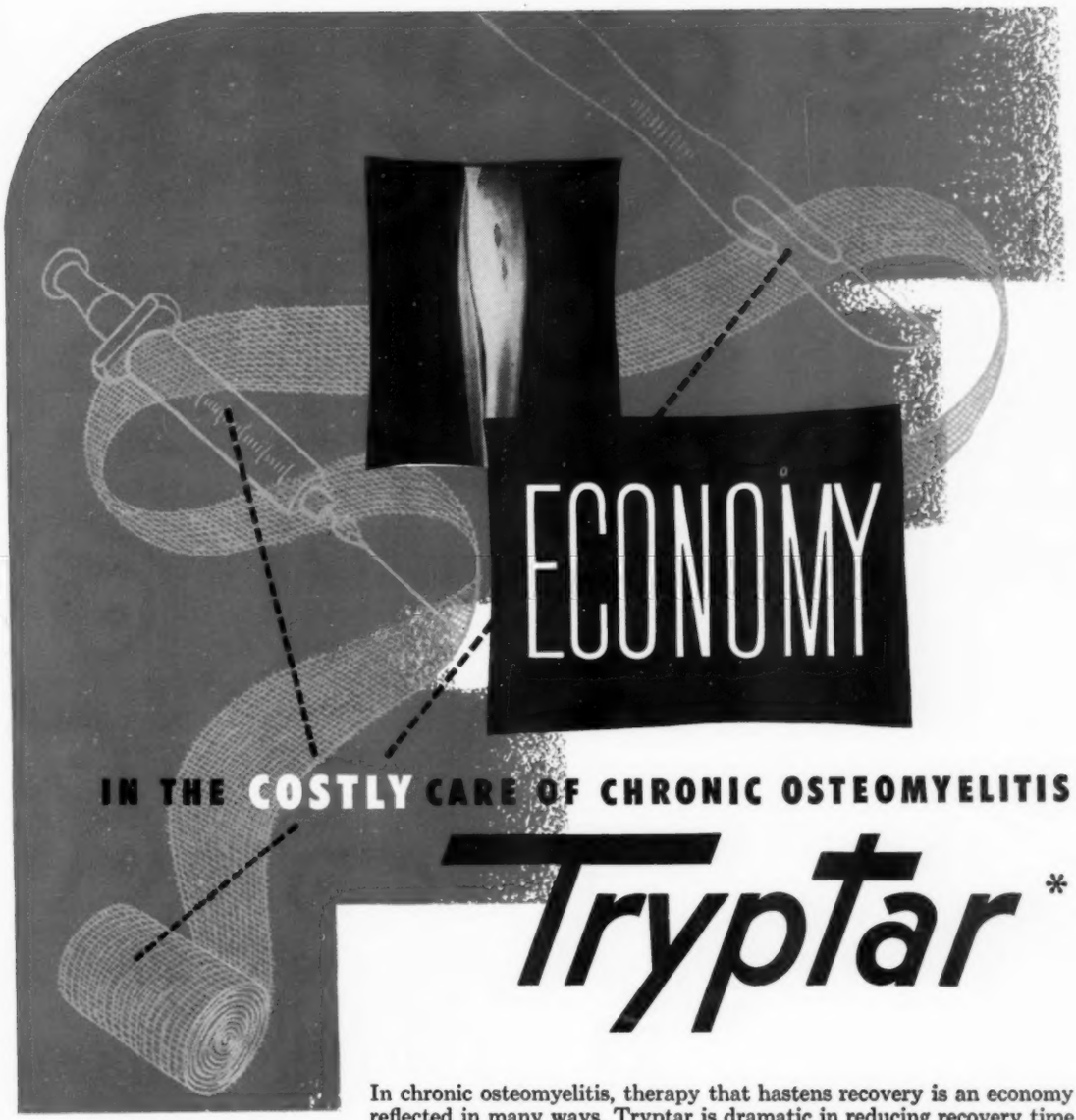

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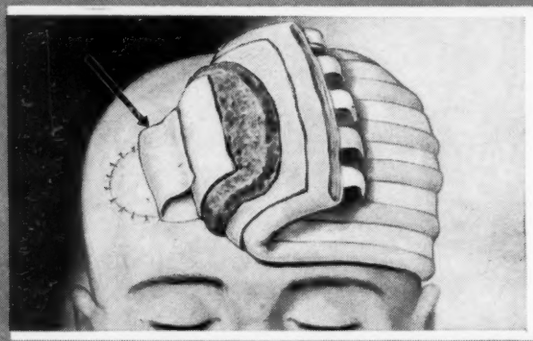

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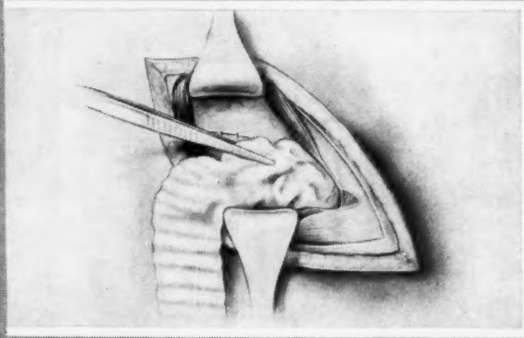

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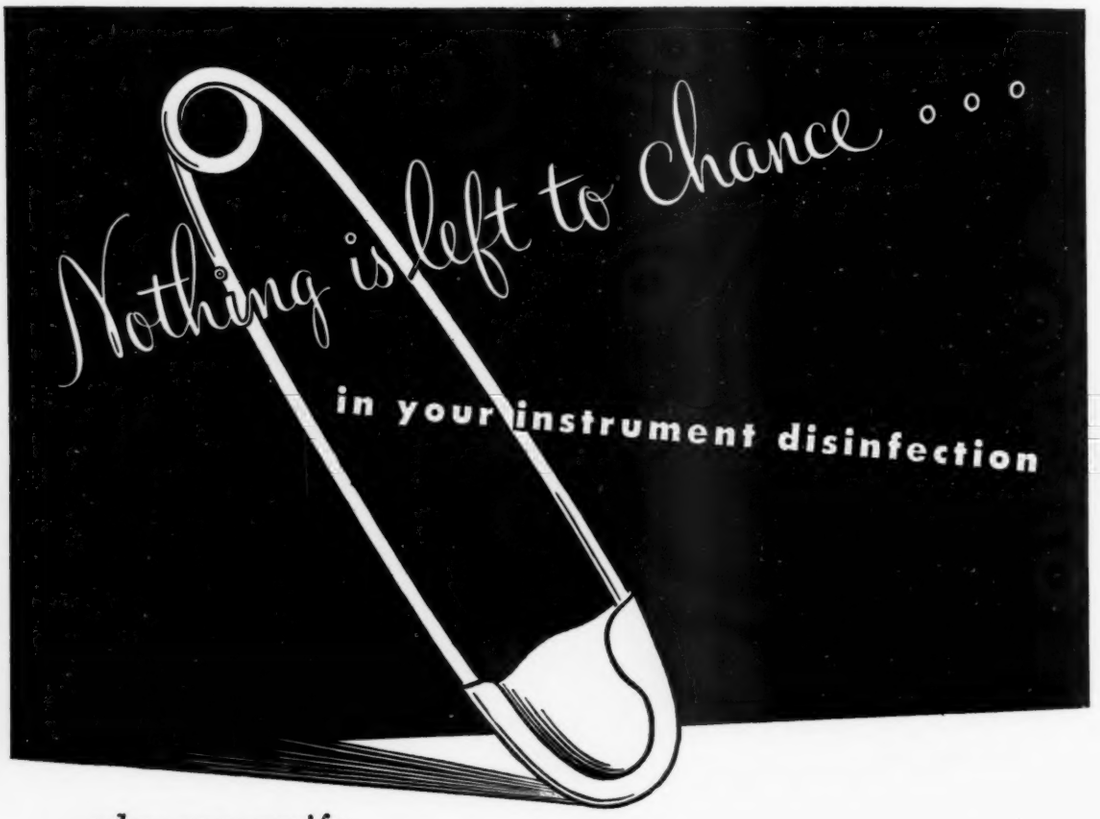


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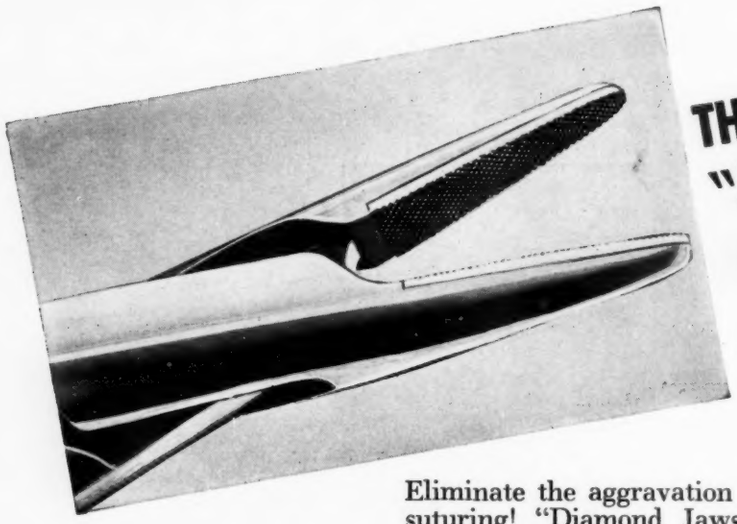

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*A–5072DJ* WEBSTER Needle Holder. 5 inches. Box lock. Stainless steel, with Diamond Jaws.....Each, *$24.75*

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# BLOOD, PLASMA and PLASMA "EXTENDERS"

## Plasma and Blood

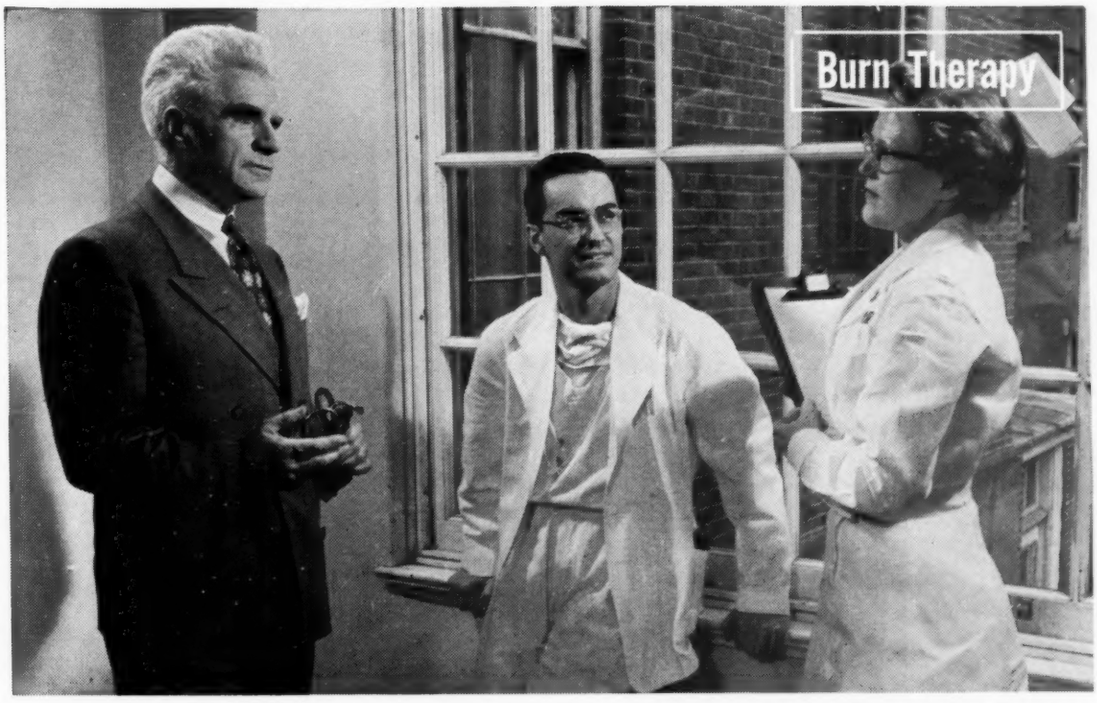
Prompt use of plasma and whole blood for directly restoring blood volume has made it possible to save the lives of countless people with severe or extensive burns. These vital substances not only restore and maintain the volume of the circulation but also restore essential nutrients. *Plasma* provides protein for tissue regeneration and many materials necessary for sustaining physiologic and metabolic functions. In addition to those elements, *whole blood* furnishes red cells for promoting the oxygen-carrying capacity of the blood. In severe burns, excessively large quantities of plasma are often lost, but ordinarily not many red cells escape from the vessels. Consequently whole blood is not generally used as often as plasma in burn treatment—especially during the early *emergency* stage when there is great hemoconcentration.

## Plasma "Extenders"

Reports on the experimental use of "plasma extenders" have focused attention on the mechanical aspects of maintaining the circulation. There is a natural tendency to become preoccupied with the purely *physical* considerations involved in restoring the fluid volume and thus to exclude—or to give less regard than is due to—vitally important *biological* considerations. The main objective in the search for plasma "extenders" has been to find colloidal materials that could imitate the natural blood colloids in their ability to increase the osmotic pressure within the blood vessels and so to maintain the circulatory volume. Such materials, it is believed, might serve as temporary expedients in the emergency treatment of shock. But it is recognized that plasma "extenders" cannot be regarded as adequate substitutes for plasma; rather, they would be intended only for emergency use—if the demand for genuine plasma should suddenly exceed the supply—and if the extenders prove to be satisfactory and safe.

## Lyophilized Plasma

Lyophilized plasma is *stable* and *portable;* can




*Discussion: Place of blood, plasma and plasma "extenders" in treatment of severely burned patients.*

# in SEVERE BURNS

be easily carried anywhere, always ready for emergency use *at five minutes' notice*—whenever blood fluids must be immediately replaced —even in extremely unfavorable field conditions in the services and under circumstances that prevail at the scene of disasters in civilian life: at automobile and train wrecks, fires in dwellings, industrial accidents, explosions, storms, and floods.

## Lyovac Normal Human Plasma, Irradiated

LYOVAC® Normal Human Plasma (Irradiated) is prepared from fresh, citrated, human blood of carefully selected donors, according to the requirements of the National Institutes of Health. The plasma is pooled, irradiated to reduce the risk of homologous serum hepatitis, rapidly frozen, *dehydrated from the frozen state under high vacuum* (the lyophile process), and sealed under vacuum.

LYOVAC Normal Human Plasma (Irradiated) is supplied desiccated in vacuum bottles to yield 50 cc., 250 cc., and 500 cc. of irradiated normal human plasma (containing approximately 660 mg. of *gamma globulin* in each 100 cc.), or smaller quantities of *hypertonic* plasma (with proportionately higher *gamma globulin* content).

## Suggested Dosage of Plasma for Burned Patients

100 cc. of plasma for each per cent of body surface burned (to all patients with 10 per cent or more of skin area burned). Half the dose should be given in the first 4-6 hours, and the remainder in the next 12 hours.

*It should be borne in mind that the method suggested is merely a rough guide for estimating the probable needs of patients.*

LYOVAC Normal Human Plasma (Irradiated) is administered at the rate of 40 to 60 drops per minute. In emergencies, this rate may be increased without reaction.

*Sharp & Dohme Philadelphia 1, Pa.*

*Published by Clay-Adams Co., Inc.*
141 EAST 25TH STREET,
NEW YORK 10, N. Y.
Showrooms also at 308 W. Washington St., Chicago 6, Ill.

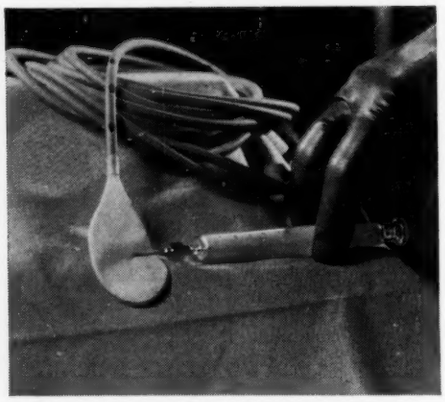
# Clay-Adams

## Cantor Tube Redesigned—Permits Improved Syringe Technic

More positive intubation results, even in difficult cases, are obtained with the new, improved Cantor Intestinal Decompression Tube. The tube has been redesigned with a sealed distal end, permitting a greatly simplified syringe technic.

A disposable, neoprene-natural rubber bag is attached to the sealed end of the tube with rubber cement. After drying, the bag is pierced with a 21-gauge needle attached to a syringe containing mercury. This technic accomplishes the following simplifications:

1) Creates a safety valve in the bag. Should the bag become distended due to intestinal gases (particularly during long intubation) the hole created by the 21-gauge needle puncture will release accumulated gases without however allowing the mercury to escape.
2) Introduces the required amount of mercury into the bag.
3) Aspirates the air from the balloon to reduce its bulk and permit easier introduction through the nasopharynx.



*Filling disposable bag with mercury.*

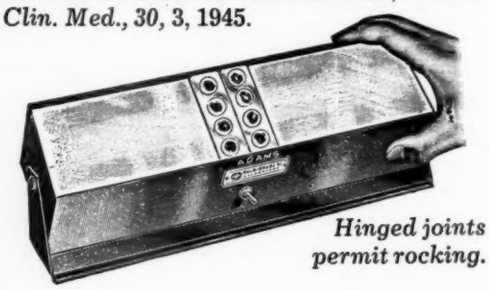
The bag and tube are introduced through the nares in the usual manner. After intubation, the bag is stripped off and discarded. The tube may be used again after disinfection.

The new, improved Cantor Tube is available in adult and child sizes. Complete instructions for the new Cantor Tube may be had by writing Clay-Adams.

### Physical Factors In Rh Blood Typing

Even illumination and proper temperature are two features of the Clay-Adams Rh Typing Box. Designed by Dr. Louis K. Diamond of the Children's Hospital, Boston, the box provides a practically uniform temperature within a range of 98°F to 107°F over the entire illuminated area. Even illumination is supplied by the 12½" x 3" opal glass viewing area, lighted by a 12" 40-watt Lumiline bulb. The box accommodates the standard 3" microscope or concavity slide, and can be gently rocked.

Reference: Diamond and Abelson, *J. Lab. & Clin. Med., 30,* 3, 1945.



*Hinged joints permit rocking.*

**HERE IS A PARTIAL LIST OF OUR PRODUCTS**

- Adams Centrifuges
- Uterine Cancer Detection Kits
- Blood Analysis Instruments
- GOLD SEAL Slides & Cover Glasses
- Supplies for Microscopy
- Dissecting Kits
- Surgical & Dissecting Instruments
- Surgical Rubber Goods
- Anatomical Charts & Atlases
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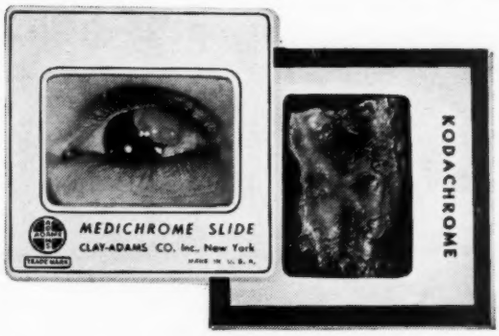
- Adams Stethoscopes
- JUSTRITE Wound Clips
- Obstetrical Manikins
- Skulls & Skeletons
- MEDICHROMES—2x2" Kodachromes

# Newsletter

FOR THE MEDICAL AND BIOLOGICAL SCIENCES
Number 7
of a Series




**Newest Teaching Aids** for laboratory technicians, medical students and nurses: Clay-Adams' extensive MEDICHROME series of 2" x 2" Kodachrome lantern slides. These slides graphically present, at low cost and a minimum of equipment, a wide variety of normal and pathological conditions in the various medical specialties. Of particular value in laboratory instruction are the following series:

MB *(Medical Bacteriology and Immunology)*—200 photomicrographs, colonies, cultures and clinical photomicrographs.

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MT *(Tropical Diseases)*—162 slides of parasites and insect carriers.

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Also available: a series of 539 slides on *Gross and Microscopic Anatomy* and 1100 photomicrographs comprising a series on *Normal Histology*. These and other series on *Breast Pathology, Uterine Cancer Diagnosis, Histopathology of Skin, Tuberculosis, Urogenital Pathology,* and *Neuropathology* are widely used for lectures and demonstrations in all levels of progressive teaching programs.

Write today stating your field of interest for descriptive listings.

**Skeleton Preparation** was originally almost exclusively a European art. Today Clay-Adams trained technicians have equaled and bettered the best examples of European bone preparations. All bones are carefully degreased, bleached and prepared with precautions to avoid decalcification. Skeletons are carefully mounted to reconstruct the normal posture as it would have been in life. Special metal parts, developed by Clay-Adams, closely approximate normal limb movements. Small metal washers prevent wear at tips of fingers and toes. Monel

and stainless steel wire is used to prevent deterioration by corrosion and rust.

Skeletons are available in mounted and disarticulated models. For teaching and classroom demonstrations, a model is available with muscle origins and insertions painted on the bones of one side, and indelibly lettered.

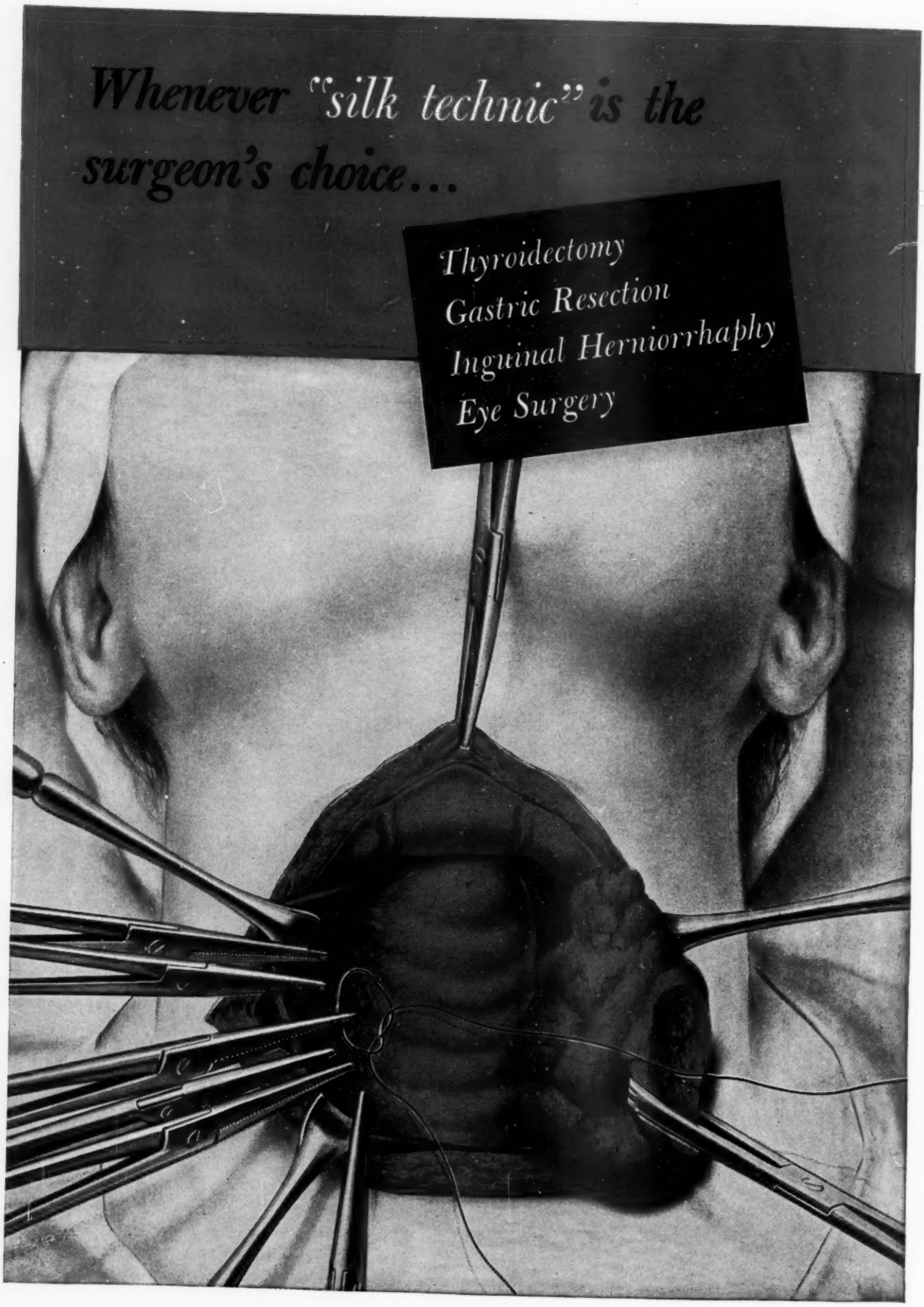
**SPECIAL LITERATURE AVAILABLE**

Detailed descriptions on the following may be obtained from Clay-Adams on request by number:

| | |
|---|---|
| Cantor Tube | Form No. 406C |
| Skeletons | Form No. 493 |
| MEDICHROMES | Please state your interest |

*Clay-Adams Company, Inc.* 141 EAST 25TH STREET, NEW YORK 10, N. Y.

CLAY-ADAMS PRODUCTS ARE AVAILABLE FROM LOCAL SURGICAL AND SCIENTIFIC SUPPLY DEALERS


Whenever "silk technic" is the surgeon's choice...
Thyroidectomy
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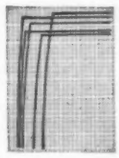
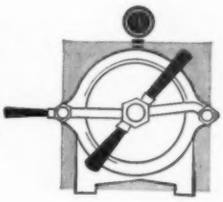
Eye Surgery

# *New improved* ANACAP®
## SURGICAL SILK

## 5 *ways better than ever before*

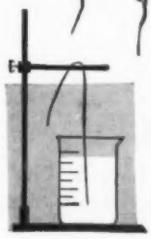


**1** *Greater tensile strength:* One of the strongest silks ever created — smaller diameter sizes can be used everywhere to minimize trauma and foreign body reaction.



**2** *Withstands repeated sterilization:* New Anacap Silk can be boiled or autoclaved *six separate times* without appreciable change in either strength or texture. In laboratory tests almost the full original strength is maintained even after 23½ hours of boiling.

**3** *Easier to handle:* Firmer, not limp, Anacap Silk speeds operative technic. Braided by a new method that minimizes "splintering" and "whiskering" it passes readily through tissues. The ease of handling Anacap makes it a "new experience" in silk suturing.



**4** *Absolute non-capillarity:* Having no wick-like action, new Anacap Silk is resistant to body fluids and will not spread an early localized infection if it occurs.

**5** *Doubly economical:* Low in original purchase price, new Anacap Silk is also low in individual suture cost because of its long sterilization life.

***In sizes 6-0 to 5 on spools of 25 and 100 yards; sterile in tubes with and without D & G Atraumatic® needles attached.***

# DAVIS & GECK, INC.

*57 Willoughby Street* D&G® *Brooklyn. 1, N. Y.*

# Meat... and the Role of Protein in Resistance to Infectious Disease

According to accumulated evidence, an adequate intake of high biologic-quality protein is needed for the generation[1] and active phagocytic functioning of leukocytes[2,3] and lymphocytes as well as for the fabrication of effective amounts of antibody globulin.[4] Both the natural and the acquired capacities of the body to counteract the pathologic stimuli of infectious disease, in considerable measure, hinge on adequate protein nutrition.[5]

Substantiating the foregoing clinical conviction, recent studies have demonstrated that protein-depleted animals subjected to pathologic stimuli display a greatly lowered capacity for manufacturing specific antibodies.[6] Conversely, repletion of their protein stores with high-quality protein quickly restores a normal capacity for antibody production. Furthermore, protein-depleted animals are both more susceptible to induced infection and less responsive to immunization than those well nourished.

Findings such as these and the fact that human antibody globulin is a highly complex protein containing all the essential amino acids justify the following authoritative deductions[6]:

a. Lacking an adequate supply of essential amino acids, the body manufactures antibody globulin with difficulty, and

b. Because of depleted protein reserves and inadequate intake of essential amino acids, persons long and seriously undernourished manifest increased susceptibility to infection due to inability to fabricate new supplies of antibody globulin.

Because of its rich content of high biologic-quality protein providing all the essential amino acids, meat can play a prominent role in maintaining the body's resistance to infection both in health and disease. Meat can be eaten in adequate quantity daily to assure a significant intake of biologically complete protein.

---

1. Cannon, P. R.: The Importance of Proteins in Resistance to Infection, J. A. M. A. *128*:360 (June 2) 1945.

2. Strumia, M. M., and Boerner, F.: Phagocytic Activity of Circulating Cells in the Various Types of Leukemia, Am. J. Path. *13*:335 (May) 1937.

3. Mills, C. A., and Cottingham, E.: Phagocytic Activity as Affected by Protein Intake in Heat and Cold, J. Immunol. *47*:503 (Dec.) 1943.

4. Elman, R., and Cannon, P. R.: Protein Malnutrition, in Jolliffe, N.; Tisdall, F. F., and Cannon P. R.: Clinical Nutrition, New York, Paul B. Hoeber, Inc., 1950, chap. 7, p. 192.

5. McLester, J. S.: Nutrition and Diet in Health and Disease, ed. 5, Philadelphia, W. B. Saunders Company, 1949, p. 347.

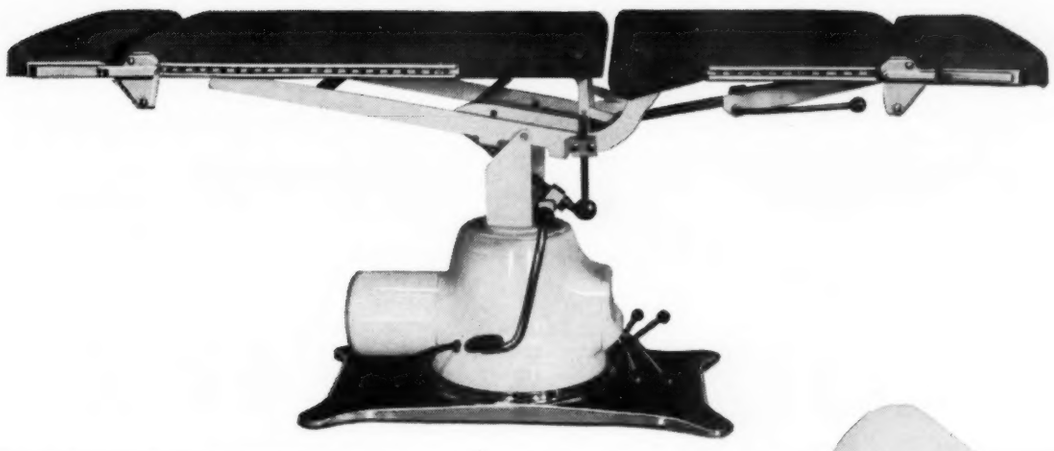
6. Cannon, P. R.: Recent Advances in Nutrition with Particular Reference to Protein Metabolism, Lawrence, Kansas, Univ. of Kansas Press, 1950, p. 19.

The Seal of Acceptance denotes that the nutritional statements made in this advertisement are acceptable to the Council on Foods and Nutrition of the American Medical Association.

**American Meat Institute**

**Main Office, Chicago... Members Throughout the United States**

# A NEW Ritter PROCTOLOGY TABLE



## NEW DESIGNED JUST FOR THE PROCTOLOGIST

## NEW GREATER EASE OF OPERATION

## HIT OF THE SHOW!

***AT THE JUNE MEETING OF THE AMERICAN PROCTOLOGIC SOCIETY***

THE new Ritter Motor-Elevated Multi-Purpose Table, Model B, Type 7, has been designed specifically for the proctologist. Patients can be quickly and comfortably positioned for proctologic work. The table as shown at the top is excellent for the proctologist who uses the Sims position. A touch of the toe on the foot pedals and the patient is moved up or down smoothly, quietly, into the exact position desired. A motor driven hydraulic mechanism does all the work . . . no physical strain. The Ritter Model B, Type 7 Table has extreme high and low positions, 30″-47″ (table top to floor). Rotates 180°. As the table is tilted to proctologic position, a patented mechanism drops seat section, as shown, so that padded end of leg rest section projects above table. The 8″ x 20″ knee rest adjusts for large and small patients and may be swung to a horizontal position as an extension of the leg rest section.

Overall dimensions of the Model B, Type 7 Table, including head rest and knee rest, are 23″ wide by 77″ long. Nylon fabric covered air-foam rubber cushions provide the patient comfort. The Ritter Model B, Type 7, Table has a 55° tilt with motor base mounting and an extreme tilt of 65° when mounted on a foot-pump base.

The Ritter Multi-Purpose Table Model B, Type 7, Proctology Table is available with motor or foot pump base. Either of which can be supplied as a mobile base. Ask your dealer for a demonstration now.

FOR ADVANCED EQUIPMENT LOOK TO

**Ritter**

COMPANY INCORPORATED
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NEW SAFETY

IN PENICILLIN THERAPY!

# COMPENAMINE

**A NEW HYPOALLERGENIC PENICILLIN SALT**

Through the routine use of Compenamine, reactions to penicillin can be reduced significantly below that encountered with other available forms of penicillin G. This hypoallergenic characteristic of Compenamine permits its use even in known penicillin reactors; in this group it reduces the incidence of reactions by at least 80 per cent. Thus Compenamine brings new safety to penicillin therapy.

A research development of C.S.C. Pharmaceuticals, Compenamine is generically designated as *l*-ephenamine penicillin G. Its clinical behavior and therapeutic performance are identical, unit for unit, with comparable dosage forms of procaine penicillin. Nearly insoluble in water and oil, its dosage forms are of the repository type.

Compenamine is priced identically with procaine penicillin G. Hence economic considerations are no obstacle to its routine use.

*C.S.C. Pharmaceuticals*

**A DIVISION OF COMMERCIAL SOLVENTS CORPORATION, 17 E. 42nd St., New York 17, N. Y.**

**THREE DOSAGE FORMS**

COMPENAMINE IS CURRENTLY AVAILABLE IN THREE REPOSITORY DOSAGE FORMS:

- COMPENAMINE (for aqueous injection), in vials.
- COMPENAMINE AQUEOUS, in vials and disposable and permanent syringe cartridges.
- COMPENAMINE in PEANUT OIL, in vials and disposable and permanent syringe cartridges.

# Preceptin®

VAGINAL GEL

## the simple method of contraception used without a diaphragm...

**Physicians and patients have long been demanding a simpler contraceptive method than jelly *and* diaphragm.**

### built on a new base

To replace the function of the diaphragm, a new and better physical barrier, incorporated into the Gel itself, was needed — one that could be depended on to cover the cervical os effectively. The new base of PRECEPTIN, achieved by blending recently developed synthetic gel-forming agents, meets this requirement, making it possible to do away with the diaphragm.

### clinically proved

Of 3270 patients using Preceptin Gel — 99.2 percent received complete protection.

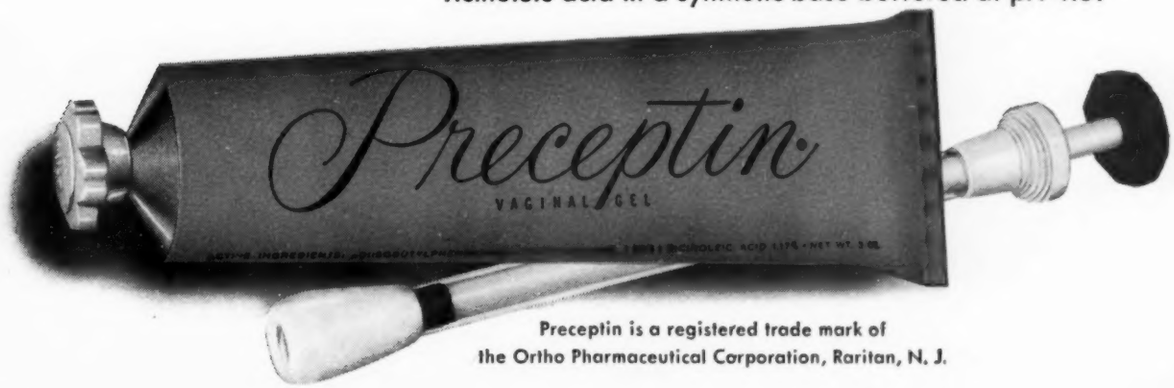
### Preceptin's new base:

1. **adheres well to the moist cervical mucosa — forms a persistent, adherent physico-chemical barrier over the cervical os.**
2. **is more miscible with semen — means greater spermicidal potency.**
3. **rapidly releases active spermicides — enables Preceptin to kill sperm on contact.**

### Preceptin Vaginal Gel

Used with measured-dose applicator.

COMPOSITION: PRECEPTIN contains the active spermicidal agents p-Diisobutylphenoxypolyethoxyethanol and ricinoleic acid in a synthetic base buffered at pH 4.5.




Preceptin is a registered trade mark of the Ortho Pharmaceutical Corporation, Raritan, N. J.

in bacterial vaginitis

# Triple Sulfa Cream
TRADE MARK

## eliminates vaginal discharge

## by controlling the cause

Triple Sulfa Cream
TRADE MARK
NET WT. 3 OZ.
ACTIVE INGREDIENTS
CAUTION: To be dispensed only by or on the prescription of a physician. Indiscriminate use may be dangerous.
Ortho Pharmaceutical Corporation
Raritan
New Jersey

**in mixed vaginal infections**

"The subjective symptom of discharge was cured."[1]

**following cervical cautery**

"The absence of usual post-cautery discharge and bleeding was very striking."[1]

**following vaginal plastic surgical procedures**

"One of the most annoying symptoms, the malodorous discharge was found non-existent in all the treated cases."[2] The outstanding relief of this distressing symptom reflects the control of a wide variety of vaginal pathogens achieved by the combined sulfonamides* in Triple Sulfa Cream.

**Triple Sulfa Cream**
TRADE MARK

is available in 3 oz. tubes. On original prescriptions specify "Triple Sulfa Cream with applicator."

*Sulfathiazole, N'acetylsulfanilamide, N'benzoylsulfanilamide.

1. Marbach, A. H.: Am. J. Obst. & Gynec. 55:511, 1948.
2. Blinick, G.; Steinberg, P., and Merendino, J. V.: Am. J. Obst. & Gynec. 58:176, 1949.

Ortho Pharmaceutical Corporation, Raritan, New Jersey

*Gynecic Pharmaceuticals*

ortho

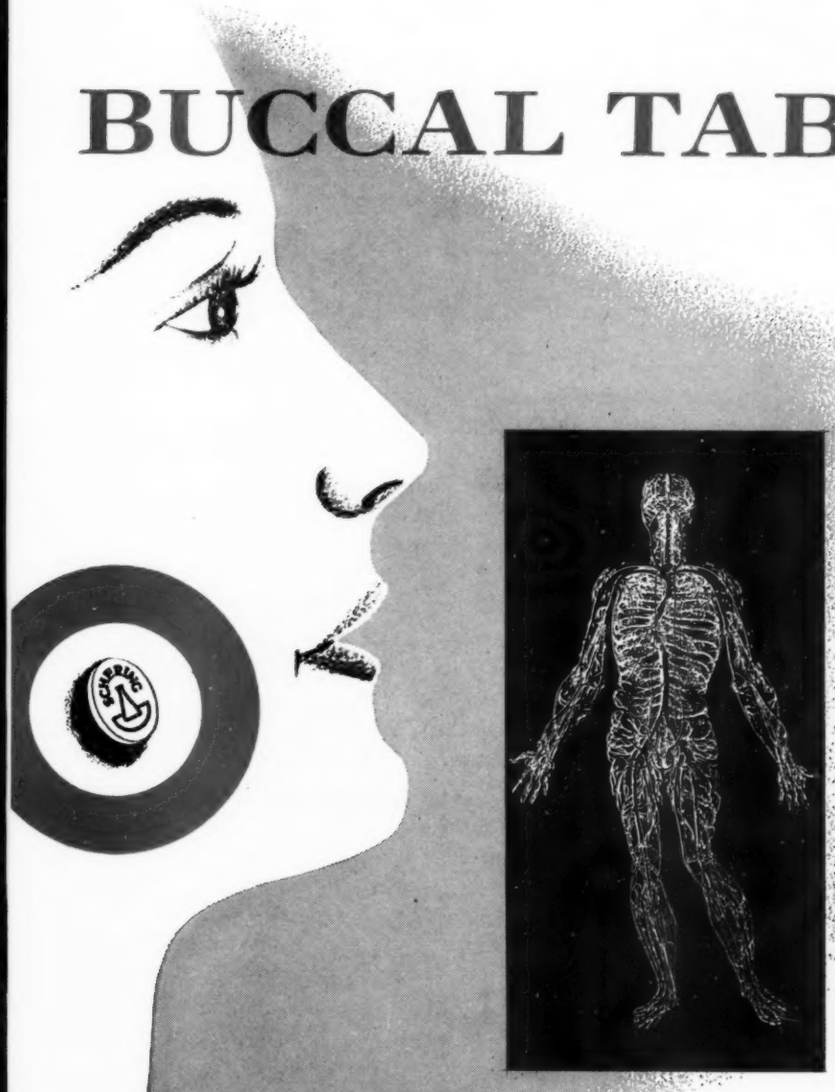
*hormones*

*by the*

*buccal route*

Optimal utilization with minimal dosage
Effectiveness approximating parenteral therapy
Convenience of administration
Economy — cost per milligram

# BUCCAL TABLETS






**CORTATE®**
Buccal Tablets: 2 mg.
Desoxycorticosterone
Acetate U.S.P.

**ORETON®**
Buccal Tablets: 2.5,
5 or 10 mg. Testosterone
Propionate U.S.P.

**ORETON-M®**
Buccal Tablets: 10 mg.
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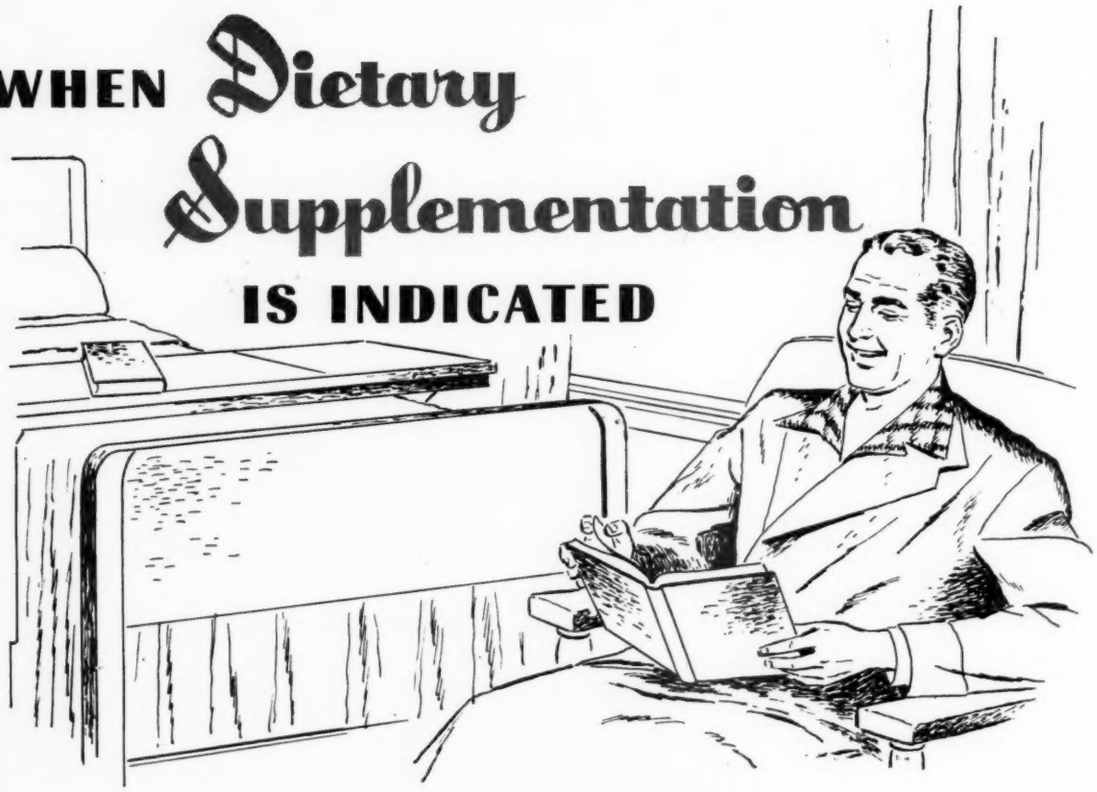
All Schering hormones
available in Buccal Tablets
are dissolved in POLYHYDROL,®
a unique *solid solvent* base.

BUCCAL TABLETS

Schering CORPORATION • BLOOMFIELD, N. J.

# WHEN Dietary Supplementation IS INDICATED



ADEQUATE nutrition of the post-surgical patient is frequently complicated by anorexia.[1] At such times supplementation of the diet with a palatable food drink containing notable concentrations of biologically adequate protein and certain vitamins and minerals proves especially useful.

Ovaltine in milk presents an excellent means for this purpose. It is added with equal advantage to liquid diets, soft or light diets, or the full diet. Its high palatability promotes patient acceptance, often when other foods hold no appeal. Its easy digestibility makes it particularly useful when nutrition must be maintained in the presence of impaired digestive capacity.

The appended table indicates the wealth of nutrients provided by three servings of Ovaltine in milk, the amount recommended for daily use.

1. Mann, G. V., and Stare, F. J.: Nutritional Needs in Illness and Disease, in Handbook of Nutrition, ed. 2, published for American Medical Association, Philadelphia, The Blakiston Company, 1951, chap. 17, p. 351.

**THE WANDER COMPANY, 360 N. MICHIGAN AVE., CHICAGO 1, ILL.**

## Ovaltine

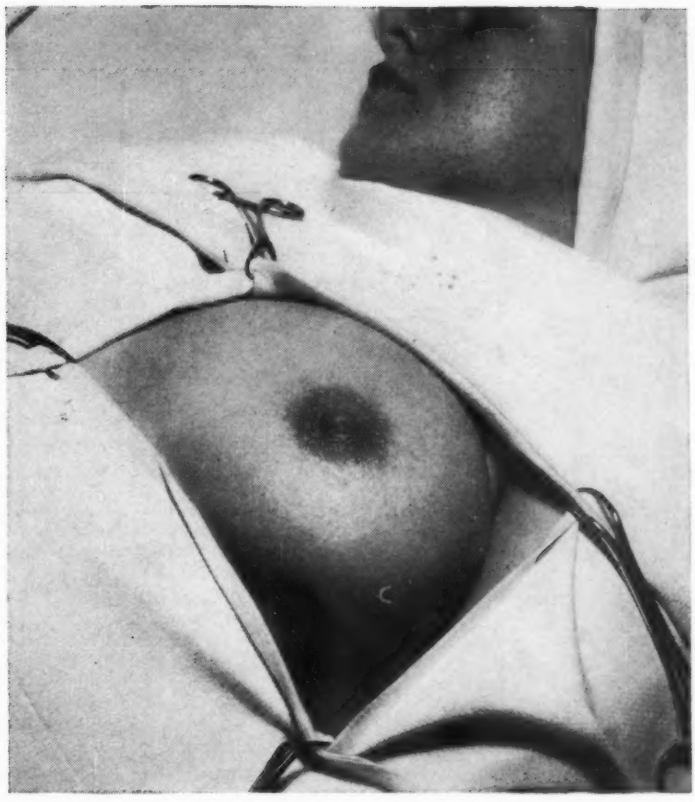
***Three servings daily of Ovaltine, each made of ½ oz. of Ovaltine and 8 oz. of whole milk,* provide:***

| | | | |
|---|---|---|---|
| PROTEIN | 32 Gm. | VITAMIN A | 3000 I.U. |
| FAT | 32 Gm. | VITAMIN $B_1$ | 1.16 mg. |
| CARBOHYDRATE | 65 Gm. | RIBOFLAVIN | 2.0 mg. |
| CALCIUM | 1.12 Gm. | NIACIN | 6.8 mg. |
| PHOSPHORUS | 0.94 Gm. | VITAMIN C | 30.0 mg. |
| IRON | 12 mg. | VITAMIN D | 417 I.U. |
| COPPER | 0.5 mg. | CALORIES | 676 |

*Based on average reported values for milk.

**Two kinds, Plain and Chocolate Flavored. Serving for serving, they are virtually identical in nutritional content.**

*The operative site prepared by new technic*



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1. Freeman, B. S., and Young, T. K., Jr.: Arch. Surg., 61:1145, Dec., 1950.

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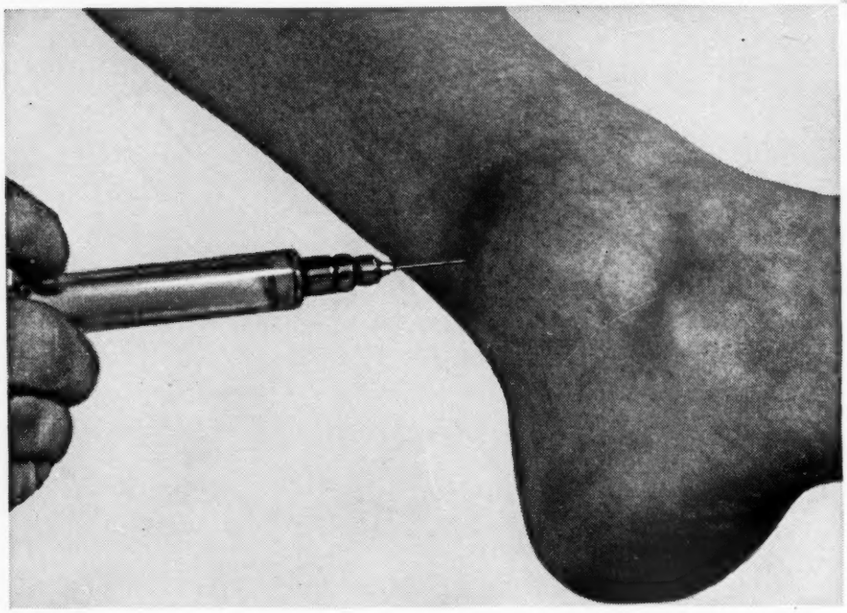

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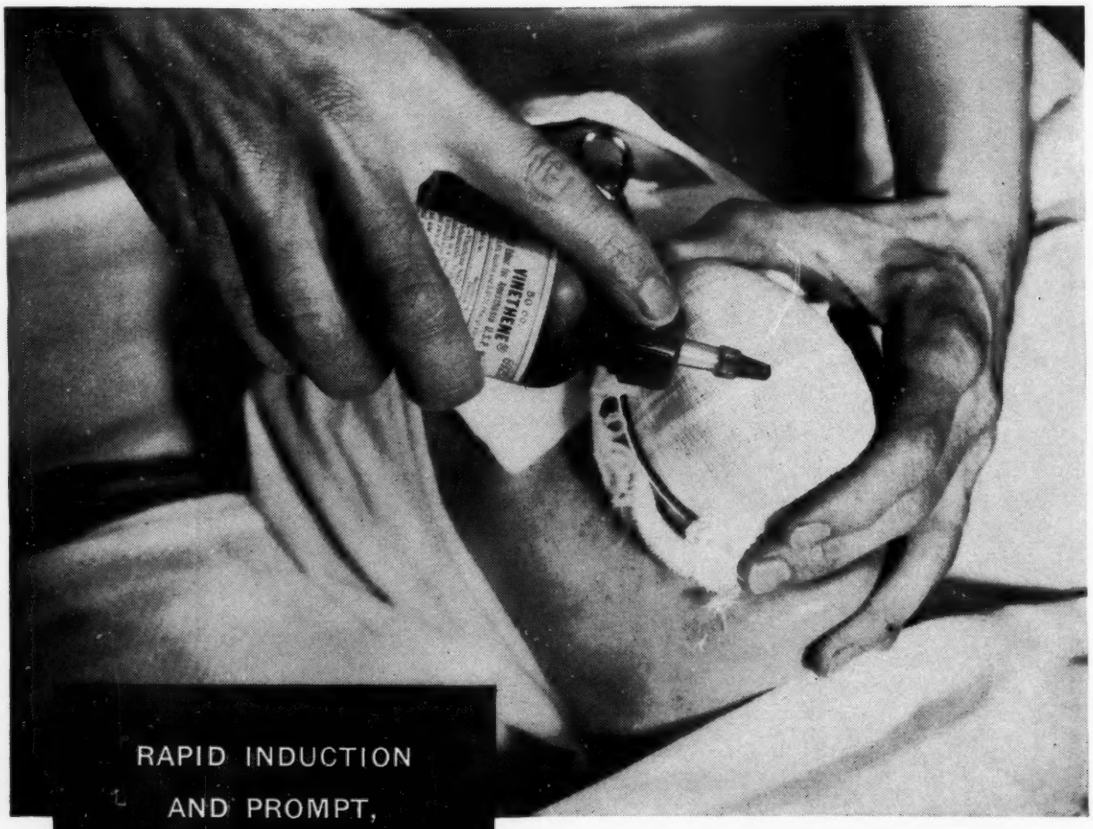


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Sixtieth Year of Publication

VOL. LXXXII DECEMBER, 1951 NUMBER SIX

# Editorial

## BLOOD VESSEL BANK FOR THE RECONSTRUCTION AND REPAIR OF BILIARY DUCTS

THE facts that biliary fistulas are always potentially very dangerous and sap the vitality of the patients and that the free passage of bile into the gastrointestinal tract is essential to life need not be emphasized. In 1908 while I was doing experimental research on blood transfusion and intestinal anastomosis by sutures at the Laboratory of the College of Physicians and Surgeons of Columbia University, the pioneer work of Dr. A. G. Sullivan attempting to reconstruct the biliary ducts with rubber tubes wrapped in omentum aroused my deepest interest in the subject. Upon my return full of youthful scientific enthusiasm from the International Medical Congress of Budapest I started investigating means of repairing and reconstructing the biliary ducts. Arterial grafts proved to be almost ideal material from an *experimental* point of view. However, it was self-evident that fresh arteries *clinically* represented unattainable material. The work of Carrel and Guthrie on preserved arteries and on tissue culture seemed to solve the clinical problems connected with the use of arterial grafts. Because of lack of adequate facilities and of the proper understanding of tissue preservation the use of preserved arterial grafts proved so disappointing that it was abandoned and finally I concentrated my efforts on the use of intestinal grafts which proved to be practically effective as reported in the June, 1915 issue of *Surgery, Gynecology and Obstetrics* and in the July, 1921 issue of the *International Journal of Gastroenterology*. However, notwithstanding a few successful clinical cases, there cannot be any doubt that reconstruction of the biliary ducts with intestinal grafts is a procedure immensely more difficult than that accomplished with arteries and is not applicable in many cases in which arteries could be successfully used. The successful utilization of preserved arteries and the establishment of blood vessel banks now make possible *clinically* the reconstruction and repair of the biliary ducts with arteries which was the best material only *theoretically* merely because arteries were not available. That arteries as preserved today are still better material for the reconstruction of the biliary ducts than they have proven to be for filling gaps in deeply located important arteries is clearly indicated by the following facts:

The thorough investigations of Swan, Robertson and Johnson proving that "at least a part of the media of the graft apparently survives" shows that its patency is permanent.

Henry Swan has successfully transplanted a segment of artery 8 cm. long in a boy seventeen years old after resection of a mycotic aneurysm of the thoracic aorta, proving the vitality of a graft longer than those required for the reconstruction of the biliary ducts, the distance between their origin and the duodenum

being normally 5 to 6 cm. made up by 3 cm. of hepatic duct and from 2 to 3 cm. of common duct located above the duodenum.

Gross, Bill and Pierce, while giving due importance to the viability of the vessel at the time of implantation and to the degree of immunologic reaction between the host and the graft, emphasize that the main factor which might influence the success of arterial grafts is the technic employed in making the anastomosis. Evidently the implantation of an arterial graft for the reconstruction of the biliary ducts, although a delicate operation, presents none of the technical difficulties inherent in reconstructing the continuity of important deeply located arteries.

If we correlate these facts with the peculiarly simple function of the biliary ducts to their surroundings and to their structure, we can readily see why preserved arterial grafts are really a godsend to biliary surgery. In fact, the biliary ducts are, in contrast to arteries, essentially mere fibrous tubes not subject to pressure the function of which is merely to convey bile to the duodenum, so that as long as they remain patent they fulfill their mission completely. The permanent patency of arterial grafts indicated by the viability of the intima is specifically enhanced when used for the reconstruction of biliary ducts by capillaries inherent in the connective tissue of new formation, i.e., adhesions, which immediately surround all foreign bodies introduced in the peritoneal cavity and which I have observed a few hours after the implantation of fresh arteries. Although locating and freeing the remnants of the hepatic duct often constitute one of the most difficult, when not impossible, procedures, the actual reconstruction or repair of biliary ducts is comparatively easy *per se* and every competent abdominal surgeon can spare potential dangerous complications to his patients undergoing operations on the biliary tracts if blood vessel banks make arterial grafts available.

I shall first describe the technic of repairing biliary ducts because their immediate repair will prevent the production of always potentially, extremely dangerous biliary fistulas and the necessity of another surgical intervention for their reconstruction. Damaged biliary ducts can be successfully repaired with an arterial patch after their edges have been approximated. The technic of this approximation varies according to whether the duct is simply incised by the surgeon in order to remove calculi or whether there is actually a loss of substance. The paramount point in both cases is that the sutures must merely *induce, never force* approximation because diseased biliary ducts stand suturing very poorly. The cut edges of the incised duct are merely approximated by a continuous suture which acts on them longitudinally *en masse* thus preventing potential tears of single stitches. When there is loss of substance, the edges are approximated as well as possible by square stitches which also approximate the edges longitudinally. In dilated ducts the approximation of the damaged edges can thus be accomplished without tension. The arterial patch is applied over the approximated edges in the following manner: The patch is first secured over the repaired edges with four stitches. Then the patch is sutured over the duct with a series of stitches, the aim of which is to bring the outer aspect of the duct and the inner aspect of the patch into close direct contact without tension so that a virtually waterproof repair is obtained. It is advisable to apply *very gentle pressure* on the patch with a warm soft sponge and when possible cover it with any available tissue.

The reconstruction of the duct is *per se* a very simple procedure. The arterial graft of the proper length must be slightly larger than the remnant of the duct in order to prevent obstruction. If the remnant of the duct is rather long and the upper end of the arterial graft can be accurately sutured, it is sufficient to introduce said remnant into the graft, the lower end of which is then simply implanted into the duodenum. If suturing conditions are poor, the hepatic duct is very short; and specifically if the surgeon has to deal with the primary right and left hepatic ducts or any abnormality, a rubber tube of sufficient length to protrude into the duodenum should be inserted into and secured to the hepatic duct or to each right and left duct and then introduced into the arterial graft. This arrangement will allow the bile to run directly from the tube or tubes into the duodenum until they become loose and are expelled. While the bile is conveyed into the duodenum through the rubber tube, adhesions will surround the arterial graft and make it permanently leakproof even when a condition made good suturing of its upper end impossible.

Preserved arteries can also be used in the

reconstruction of the esophagus and of the ureters for the same reasons that they can be used for the reconstruction of the biliary ducts.

Vascular surgeons have not only written a new chapter of surgical therapeutics because of their achievements with preserved arteries, but they have also solved the most complex problems of biliary surgery. Abdominal surgeons can prevent the occurrence of biliary fistulas and obstruction of biliary passages by the use of preserved arteries pioneered by vascular surgeons. Modern surgery can make biliary fistulas and obstructions of biliary passages surgical rarities if blood vessel banks are organized in such a manner that preserved arterial grafts can be placed at the disposal of surgeons doing biliary surgery. Although the practical difficulties of organizing such efficient banks might be great, no expense or effort should be considered excessive in view of the magnitude of the benefits to be derived from the prevention of biliary fistulas which always sap the vitality of the patient and of biliary obstructions which inherently are deadly.

A. L. Soresi, M.D.

# Original Articles

## MANAGEMENT OF DIVERTICULITIS COLI*

HOLLIS L. ALBRIGHT, M.D. AND FIELD C. LEONARD, M.D.
*Boston, Massachusetts*

DIVERTICULITIS of the colon ranks high among the degenerative diseases seen among the steadily increasing population over the age of sixty. Recent studies[1,3,4,6–8,10] have indicated that preventable bowel invalidism, serious surgical complications and fatalities due to the disease may at times be avoided by adherence to fundamental principles of management. This report records our experiences in attempting to apply these principles and especially emphasizes the following three: (1) establishment of a simple effective bowel management regimen; (2) maintenance of an adequate anal outlet and (3) proper selection and timing of surgical intervention. Eleven case reports are included.

### CONSERVATIVE MANAGEMENT

In our opinion insufficient emphasis has been placed on the role of spastic constipation and anal back pressure in perpetuating a "noisy" or symptomatic diverticulitis and initiating a train of complications related to further inflammation which may unpredictably lead to serious illness. Diverticultitis at this stage is often reversible and responds to a well planned, intensive bowel regimen, especially if anal back pressure is at the same time relieved. Where active infection is present, intramuscular penicillin and streptomycin are indicated as well.† The patient is hospitalized for at least ten days and the following orders are written, religiously carried out and constantly supervised: complete bed rest; (2) bland, low residue diet; (3) no cold or iced foods or drinks; (4) antispasmodic, 10 drops of tincture of belladonna in half a glass of water three times a day before meals; (5) sedative, ¼ gr. of phenobarbital three times a day; (6) eight cups of hot water daily; (7) continuous moist heat to the abdomen; (8) codeine if pain is present and (9) no cathartics. If no bowel movement has occurred by the fourth day, 6 ounces of warm oil either vegetable or mineral are instilled into the rectum. If results again fail, on the following day an ordinary enema is given. A less intense version of this program is followed by the patient at home, including antispasmodics, six cups of hot water daily, a special bland low residue diet and *utter avoidance of all cathartics the rest of his life.*

Considerable success has been obtained with this regimen in many cathartic-fast individuals with symptomatic diverticulitis. However, such management must always be accompanied with correction of existing anal disorder. In our experience these patients describe stools of narrow caliber with long suffering from perianal abscess, fissures, hemorrhoids, fistulas, cryptitis, pruritis and polyps. The anus is found to be a chronically spastic, hypertrophied, hyperirritatable, often fibrosed, constricted ring, the obvious result of habitual catharsis and repeated local inflammation and healing secondary to long-standing anal lesions. It is often impossible to insert the tip of a finger without obstruction and pain. A similar anal syndrome has recently been described by Newton and MacGregor.[9] With outlet contracture an overloaded colon results with overdehydrated feces, poor emptying, tenesmus, and poor result leading to overstretching and thinning of the muscular layers of the sigmoid; silent diverticula become noisy inflammatory masses and these in turn may advance to serious surgical complications. Generous dilatation and external posterior sphincterotomy (often referred to as pectenotomy) under spinal anesthesia may be required. Further office dilatations of the anal outlet may be necessary from time to time and Newton

† Oral aureomycin in the treatment of diverticulitis deserves further trial.

* From the Massachusetts Memorial Hospitals, Boston, Mass.

and MacGregor[9] recommend that the patient himself use graded Young's dilators daily.

### SURGICAL MANAGEMENT

From the pathologic stage of mere inflammation and spasm, with or without agglutinated masses of bowel loops and omentum, the process may advance to the following: (1) perforation with pericolic abscess, localized peritonitis or generalized peritonitis; (2) fistulation to the skin, bladder, urethra, vagina or other bowel loops; (3) intestinal obstruction complete or remaining incomplete; (4) inability to exclude carcinoma and (5) recurrent severe attacks despite adequate medical management, especially when urinary symptoms indicate impending colovesical fistula.

Among Morton's[8] series of 200 cases of diverticulitis in 1946 complications requiring surgery developed in 42.5 per cent. Sixteen years before, in 1930, Rankin and Brown[11] reported only two of thirty-seven medically treated cases coming to surgery. A general trend toward more radical surgical approach to forestall threatening complications has accompanied recent improvements in pre- and postoperative care with lowered operative mortality. Thus Brown[2] in 1933 wrote, "There should be a determined effort to avoid operation." Laufman[7] in a five-year collective review of the literature up to 1941 wrote, " . . . because of the high mortality attending the surgical approach and the incidence of failure after operation, surgery should be avoided whenever possible." Smithwick[12] in 1942 advocated a bold surgical attack on diverticulitis before complications occur. Pemberton, Black and Maino,[10] likewise, in reviewing the experience of the Mayo Clinic in 1947 found a drop in operative mortality from 15 to 4 per cent, largely as a result of non-absorbable intraluminal chemotherapy in preoperative bowel preparation and concluded that surgery for less complicated diverticulitis had thereby become justified. Colcock[4] of the Lahey Clinic advocates serious consideration of a planned three-stage surgical procedure among subjects of recurrent severe attacks after failure of adequate conservative management.

Although we do not disagree with the general statement of Colcock[4] that, "A transverse colostomy should be carried out in all patients with diverticulitis in whom surgical treatment is indicated," it is believed that exceptions to this rule may be made in selected cases. Abscesses with localizing peritonitis will usually require incision and drainage alone. Fecal fistulas which may occasionally result often close spontaneously, and many such patients do well. Colostomy followed later with resection and anastomosis may be required for those in whom fistulas persist. Primary exteriorization and resection is believed to have a place in selected cases and is attended by low mortality. (Table 1.) Subsequent anastomosis should be postponed several months to a year. Resection and anastomosis without a proximal colostomy may be performed in selected cases of quiescent disease without undue risk or disability (Case VI of this report.) Boyden[1] has treated twenty-five cases in this manner without mortality and believes the method deserves further trial. Proximal colostomy, in our opinion, should protect the anastomosis after resection of an active inflammatory segment of diverticulitis to avoid the morbidity illustrated by Cases IV and V of this report.

TABLE 1

144 PATIENTS RECEIVING 144 OPERATIONS FOR COMPLICATED DIVERTICULITIS AT THE MAYO CLINIC 1941–1945*

| Surgical Procedures | No. of Patients | No. of Deaths |
|---|---|---|
| Colostomy only | 12 | 1 |
| Colostomy and subsequent closure | 7 | 1 |
| Colostomy and subsequent exteriorization | 41 | 0 |
| Primary exteriorization | 38 | 1 |
| Colostomy, subsequent resection and end-to-end anastomosis | 20 | 1 |
| Primary resection, end-to-end anastomosis and colostomy | 6 | 0 |
| Primary resection, end-to-end anastomosis, no colostomy | 4 | 1 |
| Miscellaneous | 16 | 1 |
| Totals | 144 | 6 |

* Modified from Pemberton, Black and Maino[10] by permission of *Surg., Gynec. & Obst.*

The surgical treatment of active diverticulitis should in general consist of a carefully planned two-stage (exteriorization and resection followed later with anastomosis) or three-stage procedure as follows: (1) colostomy, (2) resection and anastomosis after six to ten months and (3) closure of colostomy. These stages are usually initiated by right transverse colostomy

diverting the fecal stream for several months to a year before resection and anastomosis are attempted. If the patient presents himself with acute obstruction, this colostomy will be an emergency measure as well. When first seen, 50 per cent of Morton's[8] cases were completely obstructed. Temporizing with Miller-Abbott or similar intubation device is to be condemned since a competent ileocecal valve produces a closed loop obstruction of the large bowel inaccessible to such measures. The tube must be recognized for its limited though important value in relieving associated small bowel distension. The colostomy should be placed to the right of the midline to prevent subsequent interference with surgical attack upon the lesion in the left lower quadrant at a subsequent stage. Whether the colostomy be a loop or Mikulicz type is a matter of individual preference.

Since most fistulas and abscesses heal in the presence of a diverting colostomy the question arises whether the colostomy may then be closed without resecting the lesion. Such a procedure has reactivated inflammation in most cases, less than a third remaining well in the Mayo Clinic series.[10] In the presence of a preliminary proximal diverting colostomy, resection with end-to-end anastomosis is more convenient and just as safe as obstructive resections or Mikulicz exteriorization and resection for diverticulitis. However, neither should be performed until inflammation has been allowed to subside over a period of six to ten or more months.

Time between colostomy and subsequent resection and anastomosis brings to mind immediately the confusion of diverticulitis with carcinoma, a confusion which arose in 25 per cent of 289 patients reviewed by Pemberton.[10] Both lesions occur in a similar age group and sex, with similar symptoms and even similar barium enema patterns in some instances. A distinction may not be possible at operation with the bowel lumen opened and even biopsy of the lesion may be misleading if taken from a non-representative area of an inflammatory carcinoma. If preliminary diverting colostomy is indicated, the interval between it and definitive resection must be brief for carcinoma. If diverticulitis is treated with resection and anastomosis without colostomy, the result up to now has been considered risky and even apt to lead to fatal leakage and peritonitis. Boyden's[1] results of twenty-five cases so treated without fatality, however, suggest that this danger may not be as great as previously thought.

If the colostomy has been inadvertently placed on the left, it may be feasible, even necessary, to resect it at the time of resection of the lesion. Otherwise, the suggestion of Colcock[4] is a good one, that closure be delayed until barium enema following anastomosis shows no puddling in the region of the suture line.

The mortality rate associated with various surgical treatments singly and in combination are set forth in Table 1 as they were recorded at the Mayo Clinic[10] in the chemotherapy era.

### CASE REPORTS

CASE 1. C. C., a fifty-five year old housewife, was seen in consultation twelve days after the onset of left lower quadrant abdominal pain and tenderness with fever and chills. For years she suffered with constipation, narrow pencil stools, painful bowel movements and straining at stool. Rectal examination revealed a painful, spastic and contracted anal sphincter. Barium enema demonstrated multiple diverticula of the pelvic and descending colon, with a shadow suggesting a ruptured diverticulum in the lower descending colon.

Penicillin and streptomycin were advised. In addition, anal dilatation, sphincterotomy and excision of fissure-in-ano under spinal anesthesia was strongly urged. The patient absolutely refused all suggestions remotely resembling surgery, even a simple anal dilatation.

*Comments.* This patient admirably illustrates the sort of anal difficulties that aggravate an existing diverticulosis. Her trouble was still early, though acute, when first seen but the refusal of even an anal dilatation can only mean future trouble, with advancing disease and complications.

CASE II. E. C., a fifty-eight year old woman, was admitted because of soreness in the abdomen of three months' duration. She had undergone several operations elsewhere for proved diverticulitis, including four colostomies with subsequent closure. The bowel movements were small in caliber. The abdomen, crisscrossed by many healed incisions, showed right lower quadrant tenderness but no spasm. Intravenous pyelography revealed a stone in the extreme lower right ureter and the right kidney

contained a cortical calculus in its superior pole. A barium enema demonstrated a slight kink and stricture of the proximal sigmoid believed to represent the site of a former colostomy. The patient was placed on the strict bowel management regimen described previously with attention to adequacy of the anal outlet and was discharged asymptomatic to her family physician for reference to a urologist. Two years after hospital admission the patient was well with normal daily bowel movements and had gained weight.

*Comments.* The past experience of this patient is almost more interesting than her presenting illness for it illustrates the failure to be expected when colostomies are closed without resection of the involved segment. Since she responded so well to a bowel management regimen, and had already undergone so much previous surgery, further conservative management seemed justified. On the basis of her record of four previous colostomies, however, should another be indicated, it would be our intention to resect before colostomy closure.

Case III. M. C., a forty-eight year old widow, was seen because of sudden severe left lower abdominal pain associated with a left inguinal tender mass. A diagnosis of incarcerated inguinal hernia was made. Immediate operation revealed cloudy fluid and a sigmoidal edematous inflammatory mass. The sigmoid lumen seemed adequate. The area was drained and a generous anal dilatation to four fingers was carried out while the patient was still under anesthesia.

The patient has remained generally well except for intermittent attacks of diarrhea, fever, lower abdominal pain, and nausea and has been treated with bland diet and paregoric and on two occasions a course of streptomycin and penicillin. In view of the associated hospitalizations for angina pectoris and recurrent bilateral acute thrombophlebitis a program of watchful conservative management has been continued with good clinical result from drainage over a three-year period.

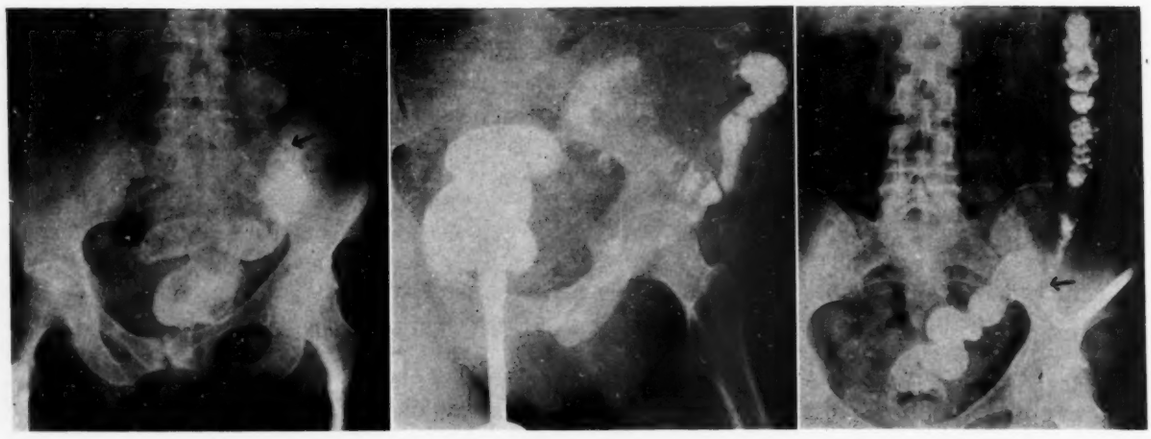
*Comments.* The diagnostic confusion created by some masquerading symptoms of diverticulitis is well illustrated herein. Only on postoperative questioning was a life long obstipation with small caliber stools revealed. Colostomy is not always necessary in the surgical treatment of diverticulitis. During numerous hospitalizations subsequent to drainage careful attention to the adequacy of the anal outlet was maintained. The inflammatory mass subsided so as no longer to be discernible either by examination or by barium enema, two years after incision and drainage.

Case IV. E. K., a fifty-six year old woman, was first seen after a nine-year history of diverticulitis treated with three incisions and drainage over a nine-year period in an outside clinic. The patient had fever and a tender palpable mass under a left abdominal incisional hernia, the site of a previous fecal fistula. Exploration revealed a large inflammatory sigmoidal and mesenteric mass adherent to the posterior surface of the broad ligament and uterus. Foul green coliform pus was present. Proximal loop colostomy was performed, after which x-rays were made. (Figs. 1 and 2.) Seven months later resection of the colostomy and lesion with anastomosis was carried out. The pathologic report was inflammatory reaction and fibrosis consistent with diverticulitis, and no evidence of malignancy.

Postoperatively a fecal fistula was demonstrated by diodrast to communicate with the anastomotic area. This was totally excised with transverse closure of its sigmoidal communication four months after its occurrence. The patient has remained well two years and three months following fistulectomy. (Fig. 3.)

*Comments.* This case illustrates two phases of the problem of fecal fistula in diverticulitis. Such fistulas may be expected from time to time following incision and drainage of peridiverticular abscesses and more especially, localized perforations. They usually close spontaneously, as in this patient. The second fistula was an operative complication and as such stands as a possible criticism of the original operation. It should be noted that resection included the colostomy so that the anastomosis was required to function from the start. Anastomoses of inflammatory bowel are prone to leak and this sort of morbidity makes one suspicious of Boyden's[1] suggestion that primary resection and anastomosis without colostomy be more generally applied in the surgical treatment of diverticulitis.

Case V. A. E., a forty-eight year old white male, was seen because of a firm, immovable intra-abdominal suprapubic mass associated with tarry stools, distention and left lower quadrant tenderness and spasm. Barium enema showed multiple small diverticula of the colon.



1 2 3

FIG. 1. Case IV. Antiperistaltic barium enema nineteen days after preliminary proximal diverting colostomy is still completely blocked by diverticulitis (arrow). This is interesting in view of the fact that isoperistaltic gas had not been blocked at this point (i. e., there was no evidence of large bowel obstruction) at operation nineteen days before this x-ray was made. Such barium block makes roentgenologic differentiations from carcinoma difficult.
FIG. 2. Case IV. After two months of a diversion of the fecal stream the barium below meets the barium via the colostomy through the involved sigmoidal segment.
FIG. 3. Case IV. Diodrast study injection via the catheter introduced into the fecal fistula fills the sigmoid from the region of the lesion (arrow).

Abdominal exploration revealed a large pelvic inflammatory mass of matted adherent small bowel and omentum attached to the sigmoid. An abscess cavity was drained and a descending colon colostomy performed.

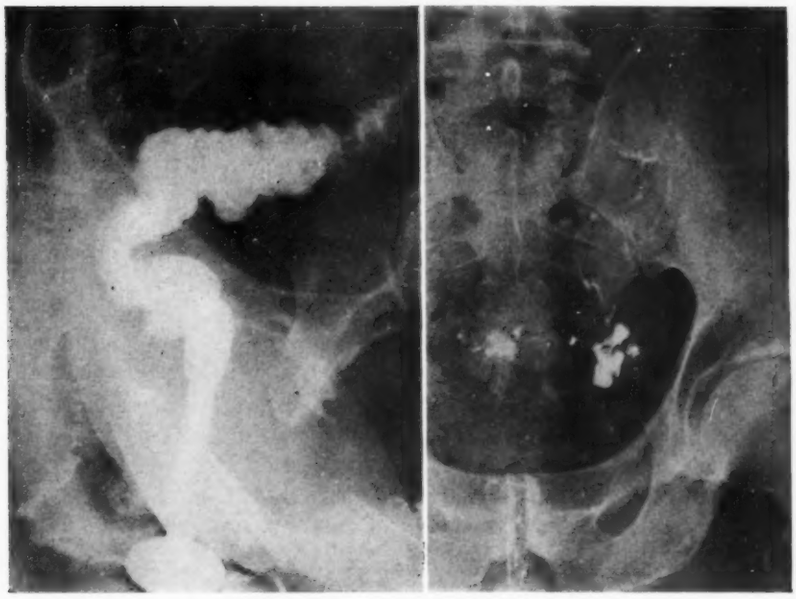
Seven months later the patient had gained 40 pounds, the mass had disappeared and the colostomy with an 8 inch segment of indurated sigmoid was resected with end-to-end anastomosis. A contracted finger tip caliber anal orifice was generously dilated.

The patient returned to work until a sudden agonizing right lower quadrant pain necessitated emergency laparotomy. Cloudy peritoneal fluid and a normal retrocecal appendix were found and removed. Adhesions were cleared but no mass or ruptured diverticulum was found. The patient has remained well two years following resection.

*Comments.* Barium enema studies of this case (Figs. 4 and 5) are consistent with localized perforation and abscess. An associated inflammatory mass made resection mandatory. The nature of the patient's most recent acute illness was never ascertained but it may have represented a complication of the anastomotic suture line. Here again Boyden[1] is not borne out in suggesting wider use of primary resection and anastomosis in the management of inflammatory diverticulitis. Such a procedure, we believe, should be limited to non-inflammatory quiescent lesions without obstruction in patients in whom resection is required for other reasons, as in the following case:

CASE VI. J. McL., a sixty-two year old woman, was operated upon for common duct stones. At exploration during the operation a large inflammatory sigmoidal mass was incidentally encountered. The patient had been treated for seventeen years for bouts of diverticulitis. A barium enema prior to discharge showed a 10 cm. partial constriction of the sigmoid. Three months after its discovery the mass was still palpable though asymptomatic. Because of failure of conservative management over seven years the mass was resected during a quiescent period together with adherent left tube and ovary. An end-to-end primary anastomosis was performed using the Parker-Kerr aseptic method. Convalescence was uneventful, the patient received streptomycin and penicillin and transfusions. Harris intestinal intubation and early ambulation were used. Pathologic examination revealed a ruptured intramural diverticulum of the colon, acute and chronic diverticulitis. The patient has been well now for over two years and has gained weight from 87 to 142 pounds.

*Comments.* Figure 6 illustrates the long (10 cm.) serrated segment of involved bowel in this case. Although the mass was known to be circumscribed and quiescent, the smooth



4 5

FIG. 4. Case v. Preoperative barium enema reveals a large extraluminal puddle of barium entirely consistent with a localized sigmoidal perforation.
FIG. 5. Case v. Postevacuation film shows the extraluminal barium puddle still undischarged.

convalescence following primary anastomosis without colostomy is nonetheless worthy of comment.

CASE VII. G. R., a forty-two year old woman complained of severe rectal pain for two weeks. A total hysterectomy had been performed in the past, the ovaries being preserved. Seven months previously the patient was treated for diarrhea with abdominal cramps and barium revealed diverticulosis without spasm. Examination on admission revealed generalized lower abdominal tenderness and rectally a tender, boggy, orange-sized, cul-de-sac midline mass. Temperature was normal and the white blood count was 10,000.

Under spinal anesthesia in lithotomy position the mass was again examined with a view to rectal drainage. However, it now felt distinctly solid and lobulated. A twisted, infarcted or hemorrhagic, solid ovarian tumor was considered and pelvic laparotomy carried out. An adherent mass was encountered attached to which was the vaginal apex, sigmoid, tubes and one visible ovary. Only after freeing up these adhesions was a 1 cm. perforated sigmoidal diverticulitis recognized. There was no free pus for culture. Resection and exteriorization were performed, forming separate colostomies in the wound. Eleven months later end-to-end anastomosis was carried out. The patient has remained well to date.

FIG. 6. Case VI. Barium enema illustrated a 10 cm. serrated segment of involved sigmoid which is too long to be carcinoma. The tapered ends as opposed to "shelving" suggest the inflammatory nature of the area.

*Comments.* Here protective pelvic adhesions were surgically disrupted before the true pri-

mary sigmoidal inflammatory nature of the lesion was recognized. Actual or imminent perforation in a hyperplastic, inflammatory mass was present. Unlike ruptured peptic ulcer suture closure or omental graft is hazardous since the sutures cut through and the bowel lumen is encroached upon. Drainage with or without colostomy invites peritonitis and certainly fecal fistula. Resection and exteriorization seemed the wiser course. A similar situation was found in one of the published Cabot cases discussed by Wallace.[13]

Case viii. E. S., a twenty-nine year old woman, was well until two days before admission when she first experienced stabbing right lower quadrant abdominal pain. A tender ovoid mass presented medially just within the right anterosuperior iliac spine.

At laparotomy a plum-sized immobile mass was found which seemed to lie within the cecal wall. Cecum, terminal ileum and ascending colon were immobilized and resected with aseptic end-to-end anastomosis of the ileum to the ascending colon. Pathologic examination of the resected specimen revealed acute diverticulitis of the cecum, normal appendix and terminal ileum. There was no evidence of malignancy. Recovery was uneventful. Postoperatively the patient was placed on a bowel management regimen and was well at the end of one year.

*Comments.* Although diverticulitis may be confused with appendicitis, its rare occurrence in the cecum makes such confusion readily understandable. There are many reasons why women with right lower quadrant abdominal pain should be explored through a right rectus rather than a McBurney incision. Had an acutely inflamed mass been found, simple drainage would have been justified. A diverting ileostomy could not be reasonably expected to improve the patient either generally or locally. Right colectomy and ileotransverse colostomy, the cancer operation in this region, would have been justified under the circumstances. Subsequent pathologic examination bore out the wisdom of the more limited surgery employed.

Case ix. L. G., a fifty year old woman, was seen on March 26, 1940. She had complained of increasing diarrhea, lower abdominal and low back pain for nine months. Pelvic examination showed a relaxed, lacerated perineum and a large bulky infected cervix; rectal examination was negative. Pelvic findings under anesthesia were consistent with a large fibroid uterus, and accordingly vaginal hysterectomy and pelvic repair were decided upon. On opening into the pelvic peritoneal cavity a large, fixed, cocoanut-sized, hard, irregular, freely movable mass was seen attached to the sigmoid colon and mesentery. Postoperatively a repeated abdominal examination again failed to reveal any mass.

Convalescence was complicated by abdominal distention, ileus, and in fact, small bowel obstruction temporarily relieved by evacuation of a large abscess behind the anterior vaginal wall. Pus with the strong odor of Bacillus coli was drained and a catheter terminal ileostomy was made. Despite intravenous prontosil daily septic temperature continued and the clinical course was steadily downhill. Feces drained copiously from the ileostomy, vagina and a suprapubic drainage site.

Postmortem examination failed to reveal the previously encountered sigmoidal mass which had apparently been dispersed by the drainage of multiple fecal fistulas running from it. Final diagnoses were diverticulitis with perforation, abscess, peritonitis and multiple intestinal fistulas.

*Comments.* This case illustrates the sort of nightmare likely to be experienced by any surgeon doing a large volume of gynecologic work. He suspects that he has made a technical error. Had this patient been treated in the present days of massive blood replacement, enlightened water and electrolyte therapy, penicillin, streptomycin, aureomycin, sulfathalidine and Miller-Abbott tubes, the outcome might have been different. Obviously elective surgery is to be avoided in the presence of an inflammatory pelvic mass when such a mass is known to be present. With free perforation and peritonitis exteriorization or colostomy is indicated. Not only peritonitis but also small bowel obstruction developed in this patient.

Case x. I. A., a fifty-nine year old housewife, was first seen one month after an operation for "adhesions" and two weeks after the sudden passage of gas and feces per urethra. A complicated previous medical and surgical history included hysterectomy. Five years previously she first noted left lower abdominal cramps and urinary frequency. Cystoscopy showed "a number of small ulcers of the bladder" but no colovesical communication.

A barium enema flowed freely to the cecum and showed several large diverticula of the

descending colon. Colovesical fistula, secondary to sigmoidal diverticulitis, was diagnosed and treated by exteriorization of the involved sigmoid loop with closure of the bladder defect by a free omental graft. Prompt skin sepsis and cutaneous fecal fistula about the resultant colostomy necessitated a second diverting Mikulicz colostomy proximal to the first. The original colostomy was closed after three months. Three months after this the second transverse colostomy was closed and six years later the patient was still well. There were no urinary complaints.

*Comments.* This case represents a woman whose uterus, being absent, was not available to protect her urinary bladder from involvement with a sigmoidal phlegmon. Edwards[5] finds colovesical fistula to be five times more frequent among males than females. The exteriorization of a segment of inflammatory sigmoid without resection might in retrospect be expected to lead to the sort of wound infection and fistulization which occurred. In this case a colocutaneous fistula was substituted for a colovesical fistula. A second proximal diverting colostomy was required to control the advancing disease in the first. Clearly, the second fecal fistula was an improvement on the first but this might have been anticipated and avoided by a preliminary diverting colostomy with subsequent resection and anastomosis.

Case xi. T. McE., a fifty-one year old white male, was admitted because of fever, left lower abdominal pain, mucus and a running rectal discharge. There was no history of antecedent constipation, small caliber or tarry stools. There was left lower abdominal tenderness. Barium by rectum stopped abruptly 5 inches from the anus, as did the proctoscope. After a week of intensive bowel preparation the abdomen was explored with a preoperative diagnosis of sigmoid diverticulitis and abscesss. A transverse loop colostomy was carried out. Carcinoma could not be ruled out but eight months after colostomy examination failed to show evidence of a carcinoma. Within two weeks of this examination the patient was admitted as an emergency case because of pernicious vomiting. Digital examination of his colostomy brought forth blood and mucus. Another rectal examination, two weeks after a previous one, detected for the first time a definite high rocky hard edge of an ulcer crater. Tetanic convulsions, uremic coma and death rapidly ensued. Autopsy demonstrated advanced sigmoid carcinoma extending to ileum and bladder with fistulas into these structures and advanced hydronephrosis.

*Comments.* Examples of confusion between carcinoma and diverticulitis of the sigmoid may frequently be found. When carcinoma is a reasonable suspicion, bold surgical attack by primary resection and anastomosis is justified, especially in view of the results previously referred to by Boyden.[1] Carcinoma must always be uppermost in the surgeon's mind and efforts continually made to rule it out. Proctoscopic biopsy and barium enema are the available means to this end. Neither were successful in this case. To make the confusion greater coincident carcinoma and diverticulitis may be found. There is no evidence to support any theory that carcinoma arises out of a preceding diverticulitis. Both diseases are relatively common in males forty to sixty years of age.

## SUMMARY AND CONCLUSIONS

1. "Noisy" or symptomatic diverticulitis with or without spasm is a reversible disease not usually requiring surgery. A bowel management regimen is outlined which if adhered to, will often effect such reversal and in addition prevent progression to the surgical complications of diverticulitis.

2. A spastic or fibrosed, contracting anal sphincter is commonly found among patients with diverticulitis and is believed to be an additional major contributing factor initiating inflammation within pre-existing diverticula. It may be held responsible in many instances for the development of major surgical complications. An efficient bowel management regimen must include vigilant maintenance of an adequate anal outlet at all times. This may in many cases necessitate anal dilatation under anesthesia, external sphincterotomy and the operative correction of associated anal disorder.

3. The surgery of diverticulitis has in the past been limited to operative correction of its complications. Recent surgical advances with greatly reduced mortality and morbidity would seem to justify a more radical approach than has been used in the past. It is now feasible in selected cases to resect symptomatic lesions in order to *forestall* complications.

4. Proximal diverting colostomy is the most frequently employed single surgical procedure in the treatment of complicated diverticulitis.

Colostomy closure without resection is doomed to failure in over two-thirds of the cases in which it is attempted.

5. Whereas with carcinoma an intensive preresection bowel preparation for one week is usually adequate, a first stage fecal diversion for several months in inflammatory diverticulitis is ideal. A cancer operation on a poorly prepared patient with diverticulitis may occasionally be forced upon the surgeon but need not be doomed to failure as suggested by the excellent results of Boyden[1] in twenty-five cases and illustrated in one of the cases in this report.

6. Resection by exteriorization is generally safer than primary resection and anastomosis without colostomy unless the segment involved is short, the inflammation chronic or slight and distal obstruction absent.

7. Fecal fistulas pose problems in management of the individual case, some important considerations being the stage of the associated diverticulitis, age of the patient, his general condition, presence or absence of distal obstruction, the state of the abdominal wall and the level of the fistula along the gastrointestinal tract.

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# CARDIAC ARREST DURING SURGERY*

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IT has always been an interesting problem as to exactly when does a patient die. Is it as soon as his heart stops? Is it when he stops breathing? Neither of these is apparently true for there are a good number of cases now reported in which the heart and respiration have stopped for several minutes and yet by proper and immediate treatment the patients have recovered and led normal and useful lives. Treatment must, however, be immediate. The following figures show why. In the human being complete cerebral anoxia for only ten seconds produces unconsciousness. If prolonged for twenty to thirty seconds, the encephalographic brain waves cease. After three to five minutes of anoxia irreversible cerebral changes take place.[21] Weinberger, Gibbon and Gibbon[19] have shown in experiments on cats that when the pulmonary artery is clamped, within 30 seconds the blood pressure drops to zero and in forty seconds breathing has ceased. If the occlusion is relieved within three minutes, spontaneous recovery takes place. Between three and four minutes resuscitation is necessary and after four minutes permanent neurologic changes or death take place.

In the human, when resuscitation is not soon enough to prevent severe brain damage, the patient may leave the operating room with a good pulse, normal respirations and a systolic blood pressure as high as 150. However, he will never recover consciousness but will expire in from twenty-four hours to, as in one case reported, twenty-six days. Death is preceded by spasticity of all the muscles, followed with flaccidity and loss of sphincter control. Death is due to the degeneration of the brain cells which has been caused by anoxia produced by cardiac cessation.

When resuscitation saves life but is not soon enough to prevent brain damage, any of the following may result: blindness, deafness, parkinsonism, athetoid and choreiform movements, speech defects and emotional instability. As a concrete example let me cite the case reported by Vernon.[18] A patient, fifty-five, had cardiac cessation for four minutes. The heart was started by sub-diaphragmatic massage. The patient became conscious the morning after the operation. For the next two weeks he spoke nothing more than a few incoherent phrases. On the fourteenth day he became restive and began to talk all sorts of nonsense incessantly. By the end of the fourth week he became maniacal and had to be sent to an observation ward. He was there for five months before he became well enough mentally to go to a convalescent home. Nine months after the accident he was examined and found to have a violent tremor of the hands, slurred speech and often repeated words over and over again. He was well enough to start work eleven months after his original condition.

This is what may happen to a patient who has had cardiac arrest if the heart beat and respirations are not started within three and a half minutes.

*Incidence.* Fortunately, cardiac arrest during surgery does not occur very often. In the Lahey Clinic in the past seven years thirteen cases have been reported.[11] At the Hospital of the University of Pennsylvania four cases were reported in two years.[10] The Pennsylvania Hospital in Philadelphia had four cases in two years. In the clinic of H. Bailey in England forty cases were reported over a period of about twenty years. Lahey[11] stated that in a busy operating room of a teaching institution two cases per year are expected.

*Etiology.* A discussion of the etiology of cardiac arrest is not very satisfactory since in very few cases has the real cause of cessation been found. It is likely that in each case more than one factor is involved. Some of the more important factors are as follows: (1) Excessive deep anesthesia; several cases have been reported in which the patient was kept too deep for too long. (2) Hypoxia too long maintained; if hypoxia from any cause is maintained too long, cardiac arrest will eventually occur. (3) Manipulation or stimulation of the vagus nerve; in thoracic surgery arrest or arrhythmia has

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followed attempted dissection of the vagus from the heart or from a tumor. (4) Manipulation about the carotid sinus; cardiac arrest is one of the well known complications in surgery of the carotid body tumors. (5) Drug sensitivity; cases have been reported in which a perfect spinal anesthesia has been given with cardiac arrest a few minutes later. In these cases sensitivity to the drug may be the cause of the arrest. (6) Surgery or manipulation with too light anesthesia, a few cases have been reported[13] in which it was thought that surgery with too light anesthesia started reflexes which caused cardiac cessation. There are probably other causes of cardiac arrest but the foregoing are the more common.

*Diagnosis.* Knowing the results of delay, it is imperative that no time be lost in making the diagnosis. When the anesthetist suddenly finds he can no longer feel the pulse, he must try to obtain a blood pressure. If he cannot get it, he must waste no further time and report it to the surgeon immediately. Lampson[12] reported a case of acute circulatory arrest of twenty-seven minutes with recovery. It is stated in his report, however, that two and a half minutes were spent making the diagnosis of cardiac arrest by precordial auscultation. This is probably the reason it took twenty-seven minutes to start the heart again. When the surgeon has been notified of the cardiac arrest, he must verify the diagnosis. If the surgeon is operating in the chest, the heart is either already visible or can easily be palpated or exposed for diagnosis. If the abdomen is opened, a hand can be placed on the aorta or on one of the large pelvic arteries. If for some reason such as a small McBurney incision or an extraperitoneal operation the aorta or the large vessels cannot be reached, he must waste no more time. The next diagnostic procedure is the opening of the chest. Dripps and his group[9] state emphatically that "opening of the thorax is the only conclusive diagnostic procedure." The left chest wall is quickly painted with an antiseptic. This takes but a few seconds; and if it prevents later infection of the pleural cavity, it is well worth it. An incision is made in the fourth intercostal space, starting about 1 inch to the left of the sternum and continuing laterally to the mid-axillary line. The pleural cavity is entered quickly and the heart is made visible. The diagnosis can then be made. Either the heart is beating normally but has been too weak to be detected, and this does happen occasionally, or it is in ventricular fibrillation or cardiac arrest. Ventricular fibrillation is recognized by noting that the heart has no regular beat but that there is an arrythmia consisting of weak, irregular, futile, squirming contract ons which seem to be going in all directions at the same time. It is important to recognize fibrillation since the treatment is different from that of complete cessation, as we shall describe later.

*Prophylactic Treatment.* The most important preventive measure during anesthesia is the maintenance of adequate oxygenation at all times. Ruth[13] in his report of anesthetic accidents showed that the most common error during the period just preceding the accident was that the anesthetist tolerated anoxia in his patient. This anoxia may well have done considerable brain damage even before the cardiac arrest occurs. When this is true, the time of arrested circulation which can be tolerated must of necessity be shortened and the chances of recovery diminished. Ruth, likewise, believed that while the patient was under light anesthesia, trauma and manipulation should be minimized because they tend to set off dangerous reflexes during that time. It is in thoracic surgery perhaps that the most definitive prophylactic treatment can be given. In cases in which it is known ahead of time that the heart may be traumatized or manipulated enough possibly to start irregularity which may lead to fibrillation or arrest, 1 per cent procaine should be used intravenously or intrapericardially, or both ways, to prevent these accidents. Large doses of atropine should also be used preoperatively to help prevent the vagovagal reflex which is so dangerous.

*Treatment of Cardiac Arrest.* Beck[6] has stated that "death in the operating room means that the patient sustains a break in his oxygen system." Resuscitation means that the oxygen system must be restored so that the blood may be oxygenated and then circulated. This is started by the use of 100 per cent oxygen in the anesthesia machine, using controlled respirations through a tight face mask by manual compression of the breathing bag. It is only after the patient has been well oxygenated that time should be taken to insert a intratracheal tube. The controlled respirations should be at the rate of about 20 per minute and never over a pressure of 20 mm. of mer-

cury. It has been shown by Thompson, Quimby and Smith[16] that with the heart in arrest artificial respiration alone does cause some blood flow to all the organs of the body. This flow, however, is too small and too inadequate to maintain life. Starting of the heart beat depends on whether the heart is found in complete arrest or in ventricular fibrillation.

If it is in arrest, cardiac massage is the quickest and best method of starting it. In a number of cases the beat has been restored by placing the index and middle fingers behind the heart and massaging it against the anterior chest wall. This may be inadequate and then the heart must be taken in the entire hand for effective massage. In this case if the ribs cannot be adequately retracted it may be necessary to cut the fourth and fifth intercostal cartilages. Most effective massage is then accomplished with the thumb in front and the fingers behind the heart. Johnson and Kirby[10] have shown in experimental animals that this type of massage produces twice the blood flow obtained with massage of the heart against the chest wall and five times the flow gotten by massage through the diaphragm. The rate of massage should be about 60 per minute.

If the heart does not start after a few minutes of massage, one may have to resort to drugs. It must be remembered, however, that drugs alone will not start the heart. However, combined with massage, one of the most valuable drugs is epinephrine. Because of its tendency to precipitate ventricular fibrillation, it should never be administered by itself but in conjunction with 1 per cent procaine. The Lahey Clinic keeps a solution of 0.5 cc. of 1:1000 epinephrine in 9.5 cc. of 1 per cent procaine in the operating room along with a sterile 10 cc. syringe ready at all times in case of this type of emergency. The solution should be injected into the right ventricle and the massage continued. If necessary, repeated doses may be given; and if an intravenous has been going, it may be injected intravenously while the heart is being massaged. Another useful drug is atropine administered in doses of $\frac{1}{75}$ to $\frac{1}{50}$ gr. intravenously or intraventricularly whenever the vagovagal reflex is suspected. It has been used most frequently in thoracic surgery, with excellent results.

Further aid in increasing the blood flow during massage is the intravenous injection of blood plasma or saline under pressure. This is accomplished by pumping air into the bottle. When this is done, the heart is felt to fill up more completely during massage. Even though the compression rate is the same, the cardiac output is greater.

In most cases in which the normal rhythm is going to start, it does so in the first one or two minutes. However, cases have been reported with recovery after twenty, twenty-seven and even forty minutes of massage.[1,12,17] In most of the long cases recovery occurred only after the intracardiac or intravenous use of procaine and epinephrine in multiple doses.

*Ventricular Fibrillation.* When the heart is found to be in ventricular fibrillation, Beck[6] advises cardiac massage at first. Cases have been reported in which the patients respond to this alone. If the massage does not work after a short time, say one or two minutes, he advises the injection of 5 cc. of 1 per cent procaine into the right ventricle and 5 cc. into the pericardium with continuation of massage. The procaine has the effect of elevating the threshold of the heart muscle to incoming stimuli and often of blocking out stimuli which may be causing and continuing the fibrillation. If the procaine and massage have no effect, then electric shock therapy must be tried. This treatment is based on the fact that the passage of a strong electrical current through the heart will cause a simultaneous contraction of all the fibers which have been contracting arrhythmically. This is followed with complete relaxation of these fibers. The picture changes then from one of fibrillation to one of cardiac standstill. Normal spontaneous rhythm may start after a short interval of standstill or massage may be needed for a short time. Electric shock therapy consists of placing an electrode on each side of the heart and passing an alternating current through it of 60 cycles, 1.0 to 1.5 amperes, and 110 volts for a period of about half a second. It should be employed only after the anoxia has been overcome by controlled respirations of 100 per cent oxygen and only after the injection of procaine into the heart cavity and pericardium. Repetition may be necessary. Cases have been reported in which two or three shocks have been necessary to break up the fibrillating reflex. It is in these cases that atropine administered intravenously has proven of great value.

Briefly then, treatment of cardiac arrest should consist of (1) immediate cardiac mas-

sage; (2) simultaneous controlled respirations with 100 per cent oxygen; (3) drug therapy with procaine, epinephrine and atropine; (4) electric shock therapy if ventricular fibrillation is present and (5) intravenous blood plasma or saline under pressure, Trendelenburg position and other general measures used for shock.

## RESULTS

Bailey[13] in 1941 reported that a personal experience with forty patients resulted in the revival of thirteen patients, of which only four lived. This is a survival rate of 10 per cent. Since that time, however, with improvement in anesthesiology and the ability to enter the chest with less danger, the survival rate has gone up. Barber and Madden[4] collected 143 cases in which forty-eight, or 33 per cent, had been treated with complete success. Lahey and Ruzicka[11] reported thirteen cases with a survival rate of 38 per cent. Johnson and Kirby[10] reported a small series of four cases occurring in the operating room. Their survival rate was three of those four, or 75 per cent. Bailey, at a sectional meeting of the American College of Surgeons in Philadelphia in March, 1950, stated that he had an experience of fifty cases of cardiac arrest, with fifteen recoveries. This is a survival rate of 30 per cent. It must be remembered, however, that most of his cases were heart cases and thus were poor risks to start with.

## CASE REPORT

The patient was a woman of sixty-three years admitted to the Northern Liberties Hospital with a history of occasional vomiting and pain in the mid-epigastrium, right upper quadrant and right shoulder for forty-eight hours. Her temperature on admission was 98.4°F., pulse 80. She was pale, with a touch of jaundice, and her skin was cold and moist. Physical examination was normal except for the abdomen which showed generalized tenderness and rigidity, more marked over the right upper quadrant.

Laboratory findings showed a hemoglobin of 56 per cent. Red blood count was 3,270,000 and white blood count 21,600 with 90 per cent polymorphonuclears. The blood sugar was 143 mg. per cent; the icteric index was 7. Sedimentation rate was 28 mm. in one hour. The serum amylase was 17.

History, physical examination and laboratory findings indicated an acute cholecystitis or acute pancreatitis, or both. The patient was treated conservatively by stopping all food and starting fluids intravenously, including fresh blood for the shock and anemia. Morphine and atropine were given every four hours. She gradually improved under this treatment. On the tenth day after admission the patient's white blood count had gone down to 10,600. A flat plate of the abdomen on that day showed multiple gallstones. On the thirteenth day after admission the patient was taken to the operating room and given a spinal anesthesia consisting of 7.5 mg. of pontocaine and 75 mg. of procaine in the second lumbar interspace. On going through the skin and subcutaneous fat there was very little bleeding, indicating a marked drop in blood pressure. The anterior sheath of the rectus was divided and the muscle split when the anesthetist stated that the patient's pulse had ceased, breathing had stopped and no blood pressure could be gotten. Immediately the peritoneum was opened and the hand placed under the left diaphragm. The heart beat could not be felt. An attempt was made to massage the heart but it could not be grasped. The left chest wall was then painted with tincture of zephiran, and a transverse incision was made in the fourth interspace, starting 1 inch to the left of the sternum and plunging immediately into the pleural cavity. This heart was seen to be in standstill. In the meanwhile the anesthetist was starting controlled respirations with 100 per cent oxygen and the blood which had been started was forced quickly into the veins by pumping air into the bottle.

When the heart was found to be in standstill, the index and middle fingers of the left hand were placed behind the heart; and it was rhythmically compressed against the anterior chest wall. The anesthetist stated that he felt a pulse beat with each compression. By this time he had also placed an endotracheal tube and was oxygenating the patient through it. In a short time the heart started to beat of its own accord. At first it was irregular and occasionally it seemed about to stop. At such times it was again massaged and soon began to beat regularly. At this time the beat was forceful and the blood pressure was found to be up to 160/90. The index finger was kept on the heart for several minutes to make sure it would keep beating. When this was certain, the chest wound was packed with a moist sponge; and the abdomen was explored. The gallbladder

was found to be enlarged and inflamed and there were multiple adhesions to the liver, duodenum and omentum.

It was believed that because of the cardiac accident it would not be wise to attempt cholecystectomy which, due to the inflammation and adhesions, would undoubtedly be a long and difficult procedure. Accordingly, a cholecystostomy was performed and the gallbladder emptied and drained. The chest wound was closed tightly after the anesthetist had blown up the lungs fully. During the cholecystostomy the patient maintained a blood pressure of 150/90 and a pulse of 110. She left the operating room in good condition. The patient had a stormy convalescence for the first four days, being kept in an oxygen tent for the first two days, and then gradually improved and was discharged with all wounds healed three weeks later. For the first two days she was euphoric but later she stated that she did not remember anything during those two days. There were no other mental or neurologic effects.

It is believed that the good results in this case were due to the fact that from the time of the notification of the cardiac arrest until the time the heart started beating of its own accord there elapsed not more than one minute. It can be broken down as follows: A second or two to open the peritoneum, fifteen seconds in attempting subdiaphragmatic massage, ten seconds to paint the chest wall, five to ten seconds to gain entrance to the pleural cavity and fifteen to thirty seconds of massage before the heart started. This totals approximately one minute. However, one must consider the arrest fifteen to thirty seconds before it was definitely ascertained. One must also figure that from the time the heart started until truly adequate circulation of the brain was achieved was from fifteen to thirty seconds. In other words, the probable time in this case, from the breakdown of the oxygen system to the brain to its adequate restoration, was probably about two minutes. Fortunately, this is still well within the limit of three and a half minutes after which irreversible damage to the brain cells occurs. When seen several months after her operation, this patient was in excellent condition.

## COMMENT

Cardiac arrest is comparatively uncommon. Yet, because delay in treatment is fatal, surgeons must be reminded of it often to keep them aware of it and always on the alert for it. They must be reminded that it should be diagnosed quickly and treated quickly.

Since cardiac arrest is diagnosed most often by the anesthetist and not the surgeon, unless he happens to be working on or near the heart, a certain rapport between the two must be developed. The anesthetist must be made to realize that the surgeon will not resent being alerted to an arrest which turns out to be false. There should be the belief that the surgeon and anesthetist are a team, one depending on the other. Only in this way will cardiac arrests be reported to the surgeon quickly and without waste of valuable time.

The surgeon and anesthetist must realize that only from three and a half to four minutes of time will be allowed them in which to save a life, or a mind. If cardiac massage with controlled respirations of oxygen are not started before that time, no matter how much cardiac massage is done after that time, death or irreversible cerebral damage will occur. They must also be made to realize that three and a half minutes are ample time in which to enter the thorax and massage the heart if the surgeon is notified within a few seconds after the arrest occurs. The more time wasted trying to verify the diagnosis by stethoscope and ophthalmoscope, the less time the surgeon has to work and get a good result. The case reported previously is a good example. No time was lost by the anesthetist in reporting the arrest. The heart was started beating of its own accord in about one minute, despite the fact that time was taken up in subdiaphragmatic massage and even in painting the chest wall before entering the thorax. The result was good and it will always be good under such circumstances. Lahey[11] stated that in every one of his reported cases he was able to start the heart beating of its own accord. Those in which massage was started early, lived; the others died.

Although in a good percentage of the cases of cardiac arrest the true cause is never found, many of these cases could have been prevented. In one group the anesthetist is responsible. This is the group in which the patient has been allowed to become and remain anoxic or hypoxic too long. In these cases the cerebral cell damage has already been started before arrest has occurred. In the other group the surgeon is responsible. This is the group in which surgery

in the thorax or about the carotid sinus has been started without the prophylactic use of procaine and atropine, as previously mentioned.

Cardiac arrests have been reported in all types of surgical procedure from such minor procedures as submucous resections in the nose to pneumonectomies. It is therefore necessary that not only the anesthetist and surgeon be prepared to treat cardiac arrest at any time, but also that the operating room should have on hand at all times the necessary drugs and instruments. It is the responsibility of the surgeon to see that these necessities are available and ready for use at any time. It is only then that the patient with cardiac arrest has any chance at all for successful survival.

## CONCLUSIONS

1. Cardiac arrest is an unexpected complication of surgery which happens infrequently; but when it does happen, it is dramatic and requires dramatic treatment.

2. The high mortality rate of the early years of this century has been reduced in the past ten years very markedly due to the ability to enter the thorax with little or no danger. It can be reduced even further in direct proportion to the reduction of time between the occurrence of the arrest and the reporting of it by the anesthetist to the surgeon.

3. The most efficient treatment of this condition is transthoracic cardiac massage aided by the use of drugs such as procaine, epinephrine and atropine.

4. Effective cardiac massage must be started within three and a half minutes. If started after that time, irreversible damage occurs in the cells of the cerebral cortex and other portions of the brain.

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# AGENESIS OF THE VERMIFORM APPENDIX*

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CONGENITAL absence of the human vermiform appendix is rarely encountered. Even some experienced surgeons[10,25,48,80] have never seen an example. Kelynack[49] stated in 1893, "I have, however, myself never met with any case where the appendix could be said to be absent except as the result of disease." In Kelly and Hurdon's[48] classic monograph upon appendicitis the following statement is made, "Cases of the complete absence of the appendix have been described but it is to be doubted that such observations have always been accurate. Nevertheless there are a few authentic cases of complete absence of the appendix." John B. Deaver[25] in his book on appendicitis observed, "I have never found the appendix absent on the operating table." Heineck[42] following an examination of the records of 3,550 autopsies performed at The Cook County Hospital in Chicago stated, "No case of absence of the appendix not attributable to appendectomy or sloughing was seen." Piersol[68] and Gray[38] in their standard textbooks on human anatomy both fail to mention agenesis of the human appendix. In 3,000 consecutive postmorten examinations performed at The Hollywood–Presbyterian Hospital between December, 1926, and January 17, 1951, Andrews and Hamrick[1] have never encountered an instance of congenital absence of the human vermiform appendix. Max Thorek[80] gave the following excellent advice, "While some authors maintain that an appendix may be absent, in several thousand appendix operations I have always been successful in locating it." I was in complete agreement with Thorek's statement until quite recently when I encountered an instance of appendiceal agenesis at the operating table. This occurrence prompted me to review the available literature on this subject, bring the case reports up-to-date and add three of my own instances to the literature. Two of these were derived from postmortem material described in a thesis that I presented at The Post-Graduate School of The University of Minnesota[18] in 1932.

## HISTORY

Only three cases (5.0 per cent) of appendiceal agenesis have been found recorded in the literature of the eighteenth century. Morgagni[63] in 1719 was the first to describe an instance of congenital absence of the human appendix; in 1762 William Hunter[44] mentioned the second recorded example, discovered while performing a right-sided inguinal hernioplasty and the third case report was made by Von Haller.[84]

The nineteenth century witnessed the addition of eleven instances (18.3 per cent) of appendiceal agenesis to medical literature beginning with Autenrieth[2] presenting his thesis at Tübingen and ending with Bryant[14] describing a surgical case from New York. These eleven case reports were very brief, gave very little clinical information and were usually depicted as medical curiosities.

The twentieth century has seen the remaining forty-six examples (76.7 per cent) added to the literature. Twenty instances of the forty-five cases, excluding Case 60 my most recent (Table 1), (44.4 per cent) were described before the end of 1915. Only five cases (11.1 per cent) have been mentioned in the past twelve years. The two best reviews of this entire subject were presented by Dorland[28] in 1925 and Bradley[11] in 1929. No serious attempt has been made in the past twenty-two years to review this interesting subject adequately and bring it up-to-date. Boyce[10] in his excellent current (1949) monograph on "Acute Appendicitis and Its Complications" presents only thirteen lines on the history of this subject and an additional ten lines describing a brief, single case report derived from the Record Library of The New Orleans Charity Hospital, their only recorded case between July 1, 1937, and July 1, 1946.

## EMBRYOLOGY

The reader is referred to the excellent studies made of the embryology of the human vermi-

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TABLE I

SUMMARY OF REPORTED INSTANCES OF APPENDICEAL AGENESIS

| Author | Cases Reported | Total Cases | Year | Sex and Age (Yr.) | How Case Was Discovered | Type Cecum Class | Appearance of Cecum; Distribution of Taenia; Additional Data |
|---|---|---|---|---|---|---|---|
| Morgagni | 1 | 1 | 1719 | ? | ? | III | Normal cecum |
| Hunter | 1 | 2 | 1762 | M, 40 | At surgery | III | Right inguinal hernioplasty; normal cecum |
| Von Haller | 1 | 3 | 1765 | ? | ? | III | Normal cecum |
| Autenrieth | 1 | 4 | 1806 | M, ? | At surgery | III | Normal cecum |
| Meckel | 1 | 5 | 1812 | F, adult | Cadaver | III | Normal cecum; no adhesions |
| Massa | 1 | 6 | 1835 | ? | ? | III | Cecum, perforated |
| Merling | 1 | 7 | 1836 | ? | ? | III | Cecum, normal |
| Tarenetzky | 1 | 8 | 1881 | ? | ? | III | Cecum, normal |
| Ferguson | 1 | 9 | 1891 | M, ? | Cadaver | III | Cecum, normal |
| Oliver | 1 | 10 | 1891 | M, 4 days | Postmortem | I | No connection between small and large intestine; no cecum |
| Lafforgue | 1 | 11 | 1893 | ? | ? | III | Normal cecum |
| Swan | 1 | 12 | 1895 | M, 40 | Cadaver | III | Normal cecum and taenia |
| Guiteras | 1 | 13 | 1898 | ? | ? | III | Normal cecum |
| Bryant | 1 | 14 | 1899 | F, girl | At surgery | III | Mesenteric adenitis |
| Fawcett and Blachford | 1 | 15 | 1900 | ? | Postmortem | III | Normal cecum |
| Picquand | 1 | 16 | 1900 | ? | Cadaver | III | Normal cecum; no adhesions |
| Michoux | 2 | 17 | 1902 | F, 24 | At surgery | III | Cecum O. K.; right perinephritic abscess |
| | | 18 | | F, 15 | At surgery | III | Right ovarian cyst; cecum, normal |
| Marie | 1 | 19 | 1903 | ? | Cadaver | III | Normal cecum |
| Huntington | 2 | 20 | 1903 | ? | Cadaver | III | Normal cecum |
| | | 21 | | ? | Cadaver | V | Normal class v cecum |
| Dillard | 1 | 22 | 1903 | F, 30 | At surgery | III | Cecum, O. K.; acute pelvic inflammatory disease |
| Schridde | 1 | 23 | 1904 | F, 1½ | Postmortem | III | Cecum, class v O. K.; pulmonary tuberculosis |
| Robinson | 1 | 24 | 1905 | F, 50 | Postmortem | I | Ileum; opened into ascending colon; no cecum |
| Dorrance | 1 | 25 | 1905 | ? | ? | III | Cecum, normal |
| Froelich | 1 | 26 | 1910 | F, 9 | At surgery | III | Cecum, normal |
| Dailey | 1 | 27 | 1910 | M, 40 | Postmortem | III | Cecum, normal |
| Bloodgood | 1 | 28 | 1911 | ? | Cadaver | III | Normal but high cecum |
| Lecompte | 1 | 29 | 1911 | ? | ? | III | Normal cecum |
| Morton | 1 | 30 | 1912 | M, 25 | At surgery | I | Ileum entered rectum; no cecum present |
| Hansen | 1 | 31 | 1912 | M, 67 | Postmortem | III | Normal cecum |
| Berard and Buche | 1 | 32 | 1913 | M, 33 | At surgery | III | Normal cecum |
| Gladstone | 2 | 33 | 1915 | Infant | Cadaver | III | Cecum, O. K., epicephalocele |
| (Chill) | | 34 | | F, 63 | Cadaver | III | Normal cecum |
| Bland-Sutton | 1 | 35 | 1915 | Fetus | Cadaver | II | Rudimentary cecum |
| Dorland | 1 | 36 | 1925 | M, 38 | At surgery | III | Normal cecum |
| Maurer | 1 | 37 | 1927 | M, 22 | At surgery | III | Acute typhilitis, O. K. |
| Cato | 1 | 38 | 1928 | ? | ? | III | Cecum O. K., Meckel's diverticulum |
| Jacobs | 1 | 39 | 1928 | F, 19 | At surgery | V | Cecum, O. K.; no adhesions |
| Spivack | 2 | 40 | 1931 | M, 50 | Postmortem | III | Cecum, O. K.; no adhesions |
| | | 41 | | F, ? | Postmortem | III | Cecum, O. K.; died pulmonary tuberculosis |
| Collins | 2 | 42 | 1932 | M, 64 | Postmortem | III | Cecum, O. K.; died arteriosclerosis |
| | | 43 | | F, 78 | Postmortem | III | Cecum, O. K.; cerebral hemorrhage |
| Sidoni | 1 | 44 | 1933 | M, 69 | Postmortem | III | Right cryptorchidism |
| Green and Ross | 1 | 45 | 1933 | M, 41 | At surgery | III | Cecum, O. K.; postoperative gangrene |
| Louyot | 1 | 46 | 1934 | M, fetus | Postmortem, hereditary lues | I | Ileum enters colon; no cecum nor ileocecal valve |
| Feldman | 1 | 47 | 1935 | F, 12 | At surgery | II | Rudimentary cecum |
| Darrah | 1 | 48 | 1936 | F, 55 | Postmortem | III | Normal cecum; insane |
| Velluda | 1 | 49 | 1936 | F, 54 | Postmortem | I | Ileum enters colon; no cecum nor ileocec valve |
| Caminiti | 1 | 50 | 1937 | M, 19 | At surgery | III | Normal cecum |
| Wulsten | 2 | 51 | 1937 | F, 22 | At surgery | III | Normal cecum |
| | | 52 | | M, 5 | At surgery | III | Normal cecum |
| Rambo and Lasky | 2 | 53 | 1938 | M, 18 | At surgery | I | Ileum enters ascending colon; no cecum |
| | | 54 | | M, 22 | At surgery | III | Cecum O. K., adenitis |
| Balice | 1 | 55 | 1939 | M, 42 | At surgery | III | Cecum O. K.; Jackson's veil |
| Farina | 1 | 56 | 1948 | F, 44 | At surgery | III | Cecum, O. K.; gallbladder disease |
| Boyce | 1 | 57 | 1949 | F, 17 | At surgery | I | No cecum, sigmoid colon on right side; no vagina, no uterus, no tubes, solitary ectopic kidney in pelvis |
| Dodek and Friedman | 1 | 58 | 1950 | F, stillborn | Postmortem sirenomelian monster sympus apus | I | Common trachea and esophagus; no cecum, no ileocecal valve, no stomach; ileum and colon undifferentiated |
| Whelan | 1 | 59 | 1951 | M, 70 | At surgery | II | Rudimentary cecum |
| Collins | 1 | 60 | 1951 | F, 34 | At surgery | III | Normal cecum; fibroid uterus, pelvic inflammatory disease, lues |

form appendix by other authors.[6,17,25,45,47,48,69,81] All agree that the human vermiform appendix is found in comparable structure only in the higher anthropoid apes. All carnivora possess some type of cecal appendix. The appendix vermiformis in humans represents only the undilated portion of the true distal apex of the adult cecum. (Fig. 1.) Therefore, no mysterious nor mystical endocrine functions may be correctly attributed to the human appendix.

FIG. 1. Photograph of a postmortem gross specimen clearly showing the vermiform appendix to be at the true apex of a conical cecum.[18]

### INCIDENCE

The incidence of agenesis of the human vermiform appendix has been partially indicated in Table II in reference to dissecting room material, postmortem examinations, intra-abdominal surgical operations and the statistics of consecutive hospital patient admissions. All of these data attests to the extreme rarity of this congenital anomaly.

### APPENDICEAL HYPOPLASIA

All past recorded instances of agenesis of the vermiform appendix in humans have been carefully studied in their original publications. As a result of this review certain cases reported[3,7,11–13,30,36,53,56,65,71,74,83,87] have been excluded because they are in reality examples of appendiceal hypoplasia. Their data are summarized in Table III under the heading of Class IV. The reputed case reports by Nikolsky in 1916 and Epshteyn in 1938 could not be obtained in their original form and were, therefore, excluded from this study. In the instance reported by Brügel,[12] Merkel who did the autopsy said it could not be stated with certainty that its disappearance was not referable to the associated pathologic process, according to Dailey.[23] Bradley[11] admitted in the summary of his article, "A case of congenital absence or of hypoplasia of the vermiform appendix, observed at operation is reported."

### APPENDICEAL AGENESIS DISCOVERED AT SURGERY

It is readily admitted that patients studied at the dissecting table or at postmortem examination afford the best opportunity for a thorough study of the gastrointestinal tract to avoid overlooking a hidden appendix or one showing extreme hypoplasia. However, instances reported from the operating table can be regarded as being genuine if diligent care is used in a meticulous search of the entire ileocecal region and a mobilization of the cecum and ascending colon to afford a view of their posterior surfaces. The unfortunate example reported by Green and Ross[39] in which the patient died after an extensive negative exploration and mobilization of the ileocecal region and the right colon was checked by a postmortem examination and the clinical diagnosis was fully verified. Additional cases reported[4,31,33,46,64,70,85,86] were examined so carefully and such meticulous efforts were made to locate the appendix by extensive explorations, associated with the concomitant absence of previous abdominal surgical scars and an absence of intraperitoneal adhesions indicative of a previous peritonitis; that they must be accepted as representing true instances of appendiceal agenesis.

*Classification.* A classification of all types of cecal and appendiceal agenesis anomalies is presented in Table III. All of the cases in this entire study are classified in accordance with this scheme. The sex distribution and the average age in years in which the data are given are also

indicated in Table III. Some doubt exists as to whether the eight examples of Class I characterized by an absence of both appendix and cecum and associated with varying sized losses of other portions of the gastrointestinal tract as the result of faulty embryonic development correctly belong in this study.

per cent) were found at the operating table; eleven instances (18.3 per cent) were discovered in cadavers and fifteen examples (25.0 per cent) were described from postmortem examinations. The reports of the remaining ten cases (16.7 per cent) did not state how the anomaly was discovered. The percentage distribution according to classes is as follows: Class I 13.3 per cent; Class II 5.0 per cent; Class III 78.3 per cent and Class V 3.4 per cent.

TABLE II
INCIDENCE OF APPENDICEAL AGENESIS

| Author | Source of Material | No. of Cases | Instances of Agenesis | |
|---|---|---|---|---|
| | | | No. | Per cent |
| Ferguson[34] | Dissecting table, University of Toronto | 200 | 1 | 0.5 |
| Kelynack[49] | Dissecting table, Victoria University, London | 200 | 0 | ..... |
| Monks and Blake[62] | Postmortem examinations, Boston | 641 | 0 | ..... |
| Heineck[42] | Postmortem examinations, Cook County Hospital | 3,550 | 0 | ..... |
| Gladstone[37] (Bradley)[11] | Postmortem examinations, Great Britain | 3,000 | 0 | ..... |
| Collins[19] | Consecutive postmortem appendices, Mayo Clinic, 1912–1931 | 4,680 | 0 | ..... |
| Collins[18] | Consecutive postmortem appendices, Mayo Clinic, 1931–1932 | 1,054 | 2 | 0.19 |
| Collins[20] | Consecutive appendectomies by 15 authors 1926–1938 | 3,003 | 0 | ..... |
| | | 30,593 | 0 | ..... |
| Collins[21] | Consecutive appendectomies by 147 surgeons at Hollywood–Presbyterian Hospital | 12,813 | 0 | ..... |
| Collins[22] | Consecutive appendectomies by 21 surgeons upon patients over 40 years of age; reported in literature | 57,660 | 0 | ..... |
| Hollywood–Presbyterian Hospital[43] | Consecutive patient admissions, exclusive of newborn, 1924–1950 | 200,000 | 1 | 0.0005 |
| Andrews and Hamrick[1] | Consecutive postmortem examinations, Hollywood–Presbyterian Hospital, 1926–1950 | 3,000 | 0 | ..... |
| Totals | Postmortem examinations | 15,925 | 2 | 0.006 |
| | Dissecting table | 400 | 1 | 0.25 |
| | Appendectomies | 104,066 | 1 | 0.0009 |
| | Consecutive hospital patient admissions | 200,000 | 1 | 0.0005 |

With the exclusion of the fourteen patients in Class IV, sixty examples of true agenesis of the vermiform appendix remain. Cases 42, 43 and 60 (Table I) are added to the literature by the author. Twenty (33.3 per cent) were males; twenty-two (36.7 per cent) were recorded as being females. The sex in the remaining eighteen patients (30.0 per cent) was not mentioned. The average length, according to sex, of the fourteen examples of appendiceal hypoplasia or Class IV types are indicated in Table III.

Table I summarizes the important data in the sixty true instances of appendiceal agenesis found in this study. Twenty-four cases (40.0

### CASE REPORTS

The first two cases were discovered while carefully studying 1,054 consecutive postmortem examinations under the personal direction of Dr. H. E. Robertson, Section on Pathologic Anatomy, The Mayo Clinic, between the years 1931 and 1932. These were originally reported in my thesis.[18]

CASE I. A male, age sixty-four years, died of generalized arteriosclerosis and cardiac fail-

ure, with secondary chronic nephritis. No scars were present on the anterior abdominal wall. His cecum was a Class III type, well developed and enclosed in peritoneum. The taeniae coli were in their normal position and terminated at the apex of the head of the cecum. No anomalies were found in this patient during postmortem examination.

CASE III. On August 4, 1950, at the Hollywood–Presbyterian Hospital a female, age thirty-four years, was operated upon by the author because of a large uterine pelvic mass that was causing symptoms of pelvic crowding. A large multiple fibroleiomyomatous uterus was found at laparotomy together with bilateral chronic salpingitis caused by an old pelvic inflammatory disease. A total abdominal hysterectomy and a bilateral salpingectomy were performed upon this patient in a routine manner without incident. There were no intraperitoneal adhesions and her cecum was a Class III type of normal size and development. It was surrounded by a peritoneal covering and was quite mobile. The lateral taeniae coli converged at the apex of the cecum in a normal manner. No evidence of appendiceal hypoplasia was present and the appendix was routinely looked for but could not be located. I jokingly remarked to the hospital surgical resident who was assisting me that this was an apparent instance of agenesis of the appendix but that

TABLE III

CLASSIFICATION OF ABNORMAL CECAL DEVELOPMENT AND ITS RESULTANT ANOMALIES

| Class | Type | Cecal and Appendiceal Anomalies | This Reported Series | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Average Ages (Yr.) | | | Sex | | | Total No. |
| | | | Males | Females | Not Stated | Males | Females | Not Stated | |
| I | Failure of development of cecal anlage | Cecum and appendix absent | 10.25 | 30.25 | ..... | 4 | 4 | 0 | 8 |
| II | Partial development of cecal anlage | Rudimentary cecum, no appendix | 70.0 | 12.0 | Fetus | 1 | 1 | 1 | 3 |
| III | Full development of cecal anlage, no development of appendiceal anlage | Normal cecum, no appendix | 39.48 | 31.31 | ..... | 17 | 14 | 16 | 47 |
| IV | Full development of cecal anlage, early cessation of appendiceal anlage | Normal cecum, rudimentary appendix | 48.0 | 39.3 | ..... | 5 | 3 | 6 | 14 |
| | | | | | | (Average length in mm.) | | | |
| | | | | | | 2.6 | 12.3 | 8.6 | |
| V | Full development of cecal anlage, failure of the appendiceal anlage to become differentiated; its growth keeping up with that of adult cecal portion | Greatly enlarged and deformed cecum distal to the ileocecal valve, no appendix | ..... | 19.0 | ..... | 0 | 1 | 1 | 2 |
| Totals for this series | | | 35.15 | 29.42 | ..... | 27 | 23 | 24 | 74 |
| Subtotals, appendiceal agenesis | | | 35.15 | 30.0 | ..... | 22 | 20 | 18 | 60 |

intraperitoneal adhesions were encountered. Microscopic sections taken through the confluence of the lateral taeniae coli at the cecal apex revealed no evidence of the existence of the veriform appendix and no other congenital anomalies were found in this patient during postmortem examination.

CASE II. A female, age seventy-eight years, died from a sudden, right-sided, massive cerebral hemorrhage. The taeniae coli were in their normal position; no intraperitoneal adhesions were encountered and no anterior wall abdominal surgical scars were present. Her cecum of Class III type was well developed but was covered only on its anterior and distal surfaces by peritoneum. Microscopic sections taken through the confluence of the lateral taeniae coli revealed no evidence of the presence of the vermiform appendix. No other congenital

upon mobilization of the cecum and ascending colon medially we would demonstrate a retrocecally located vermiform appendix. However, such mobilization as far cephalad as the hepatic flexure of the colon and meticulous inspection of the posterior surface failed to reveal any evidence of the presence of a vermiform appendix. No other congenital anomalies were found in this case during the course of the abdominal exploration. Complete postoperative barium x-ray studies of the entire gastrointestinal tract failed to visualize an appendix or any other diverticulum-like structure.

## COMMENTS

Undoubtedly, many additional case reports are buried under misleading titles as evidenced by the recent examples found under the contributions by Dodek[27] and Whelan.[85] Recent contributors to this subject failed to include my two previous case reports that were buried in the large amount of data contained in a 570-page thesis.[18] Probably additional instances have been overlooked in the foreign medical literature. The recent presentation of Whelan[85] was unduly concerned about a fish-bone perforation of a Meckel's diverticulum which is not uncommon when the great rarity present was the congenital absence of the appendix. This was mentioned in these words, "Although a very thorough search was made for the appendix none could be found and the characteristic caecal bulge below the juncture of the ileum with the ascending colon appeared to be absent. The patient had had no previous operation."

## SUMMARY

1. The available literature on agenesis of the human vermiform appendix has been critically reviewed. Fifty-seven true instances have been collected. Fourteen additional reputed cases have been discarded and classed as examples of hypoplasia of the vermiform appendix.

2. Three additional case reports have been added by the author from his clinical and postmortem records. Two instances were discovered at the postmortem table and the third instance recently at the operating table.

3. These sixty examples of appendiceal agenesis have been classified according to probable etiology, sex, age, manner of discovery and additional interesting clinical findings.

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# EFFECT OF VARIATION IN LENGTH OF DECOMPRESSION TUBE UPON BOWEL WALL

## A CLINICAL AND LABORATORY STUDY

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THE widespread acceptance of the long intestinal decompression tube has been responsible in part for a remarkable reduction in the mortality rate due to blockage of the intestinal stream. Because of this various types of tubes employing different propulsive mechanisms were developed. The one factor common to all such tubes, however, was the fact that they were made 10 feet long. There seemed to be no apparent reason why the tube should be 10 feet long since no previous studies had been carried out to determine the optimum length of tube to be used as an intestinal decompression tube.

During the past five years isolated case reports such as that of Warren and Cattell[1] described the development of intussusception as a result of using an intestinal decompression tube. It has long been known that the small bowel pleats itself along the length of the tube much like an accordion so that often with the 6 foot mark at the nose the tube head has at times been observed to emerge through the anus. Because of this one author[2] recommended that the tube be made only 4 feet long. The pleating of the small bowel along the intestinal decompression tube might occur in such a fashion that uncommonly a true intussusception occurred which resulted in perforation of the bowel. Usually such intussusception was entirely reduced when the tube was removed, but the possibility of true intussusception should always be considered.

Because there was a variability of opinion with regard to the length of intestinal tube that would best be employed and because of the case reports of intussusception due to intubation, it was decided to study what the effect of varying the length of intestinal decompression tubes would be upon the bowel wall. Ideally the intestinal tube should be of such a length that it least interferes with the normal physiology of the small bowel. The functions of this bowel are motility (peristalsis), secretion and absorption. The ideal length of tube would be one, then, which least interfered with these functions.

### METHOD

This study was divided up into two parts. The first was a clinical study in which a fixed amount of intestinal tube was permitted to pass downward into the gastrointestinal tract and its effect upon the bowel wall noted at operation. As part of this study we noted the marking at the nose of each tube placed in a patient whose abdomen was to be opened. The condition of the bowel strung along this tube was then correlated with the length of tubing down the bowel and the position of the tube as shown by x-ray prior to operation. Secondly, a laboratory study was carried out in which fresh autopsy specimen was used. An intestinal tube was then threaded from the stomach along the small bowel to the ileocecal valve. Three different lengths of tube were threaded in this fashion using the stomach and the ileocecal valve as fixed points. It was believed that by so doing the conditions present at operation in the living subject should be reproducible.

### RESULTS

When 4 feet of intestinal tube had passed down the gastrointestinal tract, roentgen studies invariably showed the tube head to be in the upper ileum or lower jejunum. Its position was fairly constant as noted in numerous patients. At operation in such patients the plications of the bowel about the tube were generally fairly loose. Peristaltic movements of the bowel pleated along the tube could readily be demonstrated. This was especially the case when the obstruction was mechanical in nature and as a result hyperperistalsis of the bowel

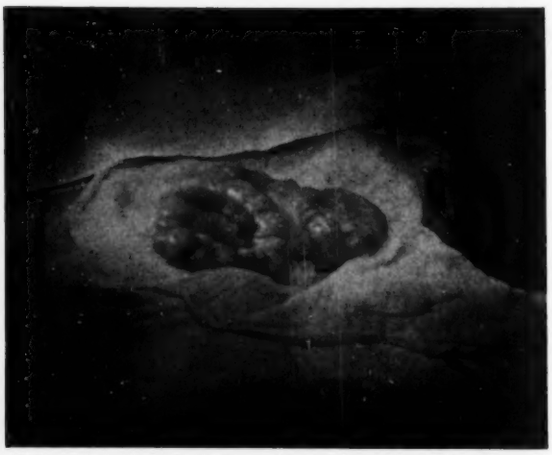

FIG. 1. Four feet of intestinal tube down the bowel; note the tight plication of the bowel as seen at operatio; very little peristaltic activity noted in this bowel threaded on tube.

proximal to the point of obstruction could be demonstrated. If the case were of long standing and atony had set in, little or no peristaltic activity could be demonstrated at operation. In an occasional case with obstruction at the terminal ileum or ileocecal valve peristaltic activity may be so vigorous that the tube head would be found just proximal to the point of obstruction in the ileum. This was especially likely to occur on the second or third day after the tube was passed. In such cases as a result of the plication of 22 feet of bowel upon a 4 foot length of intestinal tube the plications of the bowel about the tube were tight. Note in Figure 1 just how tightly the small bowel was plicated upon a 4 foot length of tube. Preoperative roentgenograms of this case demonstrated the tube head to be at the ileocecal valve. There was very little peristaltic activity noted in the bowel so tightly plicated upon the 4 foot intestinal tube. In those cases in which peristaltic activity was vigorous as a result of mechanical obstruction and in which intubation was started early a rapid descent of the intestinal tube was the usual finding. If 4 feet of tube were permitted to pass down into the gastrointestinal tract and then the tube fastened to the face with adhesive to fix it in position, the vigor of the peristaltic activity resulted often in an intussusception-like effect. In this type of case pleating of the bowel tightly upon the 4 foot length of tube would be the result. True intussusception in such cases, although rather uncommon, does occur as shown by such case reports as that of Warren

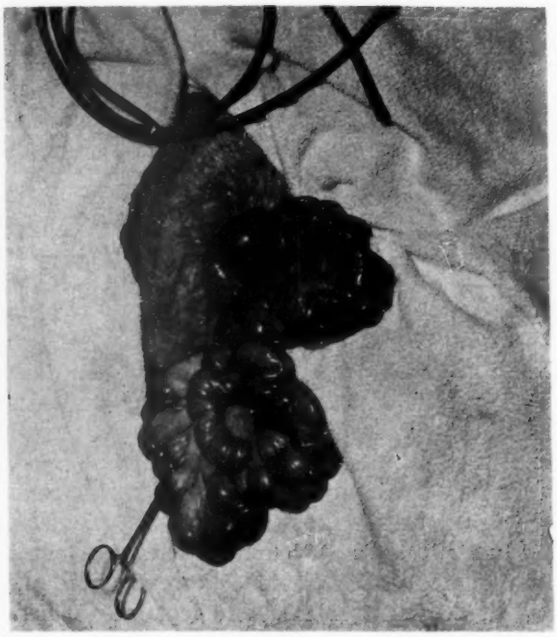

FIG. 2. Autopsy specimen showing 4 foot tube passed down the bowel from stomach to cecum; note how the gross appearance resembles that seen in Figure 1.

and Cattell. Generally removal of the tube results in a disappearance of the pseudo-intussusception associated with such cases of intubation.

An attempt was made to reproduce this condition of the bowel in the laboratory. Using a fresh autopsy specimen a long intestinal decompression tube was inserted through the stomach and threaded to the ileocecal valve thus approximating conditions in the living. It was noted that the 22 feet of small bowel would tightly pleat itself upon the 4 foot length of tube without any difficulty. Figure 2 demonstrates the tight plication that resulted when a 4 foot length of tube was passed from the stomach to the ileocecal valve. Comparison between Figure 1 taken from a living patient and Figure 2 taken from an autopsy specimen shows almost identical findings.

### SIX-FOOT TUBE

In those cases in which a 6 foot length of intestinal decompression tube had been passed down the gastrointestinal tract the usual finding at x-ray was the presence of the tube head at or through the ileocecal valve. In the vast majority of cases the tube head could readily be demonstrated at the ileocecal valve in forty-eight hours with the tube down to the 6 foot mark. In a smaller percentage of cases

the tube head would be demonstrated in the colon. The cecum and ascending and transverse colon were the most common locations for the tube head under such conditions. Mechanical obstruction of the left colon including rectosigmoid was the most common lesion producing obstruction necessitating the use of the long intestinal decompression tube. In this type of case peristaltic activity is generally unimpaired or may even be markedly increased in an effort on the part of the bowel to overcome the obstructive lesion. Under such conditions the downward movement of an intestinal decompression tube was invariably rapid. At operation with the tube down to the 6 foot mark the plication of the bowel upon the tube was usually found to be much looser than in the case of the 4 foot long tube. The plication was usually not found to be uniform along the entire length of the tube. Areas of very loose or even no plication alternated with areas in which a moderate plication occurred. In several areas along the length of the tube the plication of the bowel was found to be quite tight. In all cases observed at operation the note was almost uniformly made that in those areas of the tube in which the bowel was loosely or not plicated almost normal peristaltic waves could be demonstrated. In the areas in which the plication was tight, however, little or no peristaltic activity could be demonstrated. It was quite evident that the tighter the plication of the bowel along the intestinal tube the greater was the interference with peristaltic activity of the bowel. Figure 3 demonstrates conditions found at operation in this type of case. Note the variation in plication on the tube.

The distance which the long intestinal tube was found to have passed into the gastrointestinal tract could not be foretold with absolute certainty without a flat plate of the abdomen. The speed with which the intestinal tube passed down the bowel depended upon a variety of factors: age of the patient, type of disease present, peristaltic activity or absence of activity of the gastrointestinal tract, amount of mercury used in the tube head and finally whether the patient could be ambulated or not.

When the 6 foot mark appeared at the external nares, the character of the aspirated material usually would indicate that the tube was well down the small bowel; but its exact level was found to be extremely variable depending upon the aforementioned factors. At

FIG. 3. Six feet of intestinal tube down the bowel; note the variation in plication. In the portion of bowel loosely plicated peristalsis was active whereas in the tightly plicated bowel there was little or no peristaltic activity seen.

times a tube of this length would be found to have passed through the entire gastrointestinal tract and emerged from the anus. This was particularly apt to occur in patients presenting good peristalsis and with the intestinal tonus good. This occurred on six occasions during the present study. In all six patients the intestinal tube was passed to treat marked postoperative intestinal distention due to bowel atony or hypotony. With intestinal decompression obtained the return of peristaltic activity was rapid and the peristalsis strong. It was surprising how rapidly such patients showed a return of good peristaltic activity following successful intubation and decompression.

In a small percentage of cases, particularly in the aged with ileus as a result of bowel atony unassociated with any obstructive or inflammatory lesion, with the 6 foot mark at the nose the tube head would be demonstrated in the terminal jejunum or upper ileum. In such cases it was usually difficult to ambulate and move the patients about; in addition a poor muscle tonus was almost always present.

The most common point at which the tube head was found with this length of tube in the bowel was in the terminal ileum or right colon. In most cases the tube head could be demonstrated by x-ray and at operation to be at or

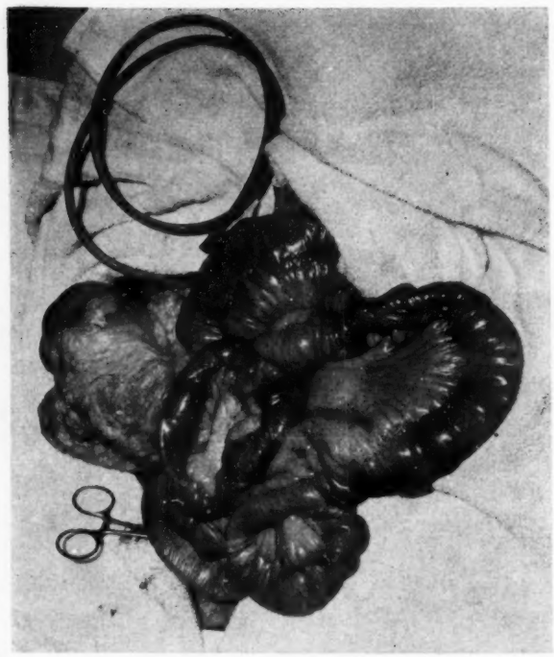

FIG. 4. Autopsy specimen showing 6 feet of tube passed down the bowel from stomach to cecum; note how the gross appearance resembles that seen in Figure 3.

could be demonstrated in the sigmoid or left colon.

Using a fresh autopsy specimen an attempt was made to reproduce the clinical findings with regard to the degree of plication of the bowel upon the tube. A tube was passed from the stomach to the ileocecal valve until the 6 feet of tubing had been passed. Figure 4 demonstrates almost identical findings as seen clinically at operation. Note the areas of lack of plication and then the range from loose plication to fairly tight plication along the tube. A comparison between Figure 3 taken at operation and Figure 4 taken from an autopsy specimen demonstrates the similarity grossly.

### TEN-FOOT TUBE

In those cases in which a 10 foot tube had been passed down the gastrointestinal tract the position of the tube head was found to be much the same as when the 6 foot length of tube was used. In most cases the tube head could be demonstrated in the terminal ileum at or near the ileocecal valve. In a smaller percentage of cases the tube had passed through the ileocecal

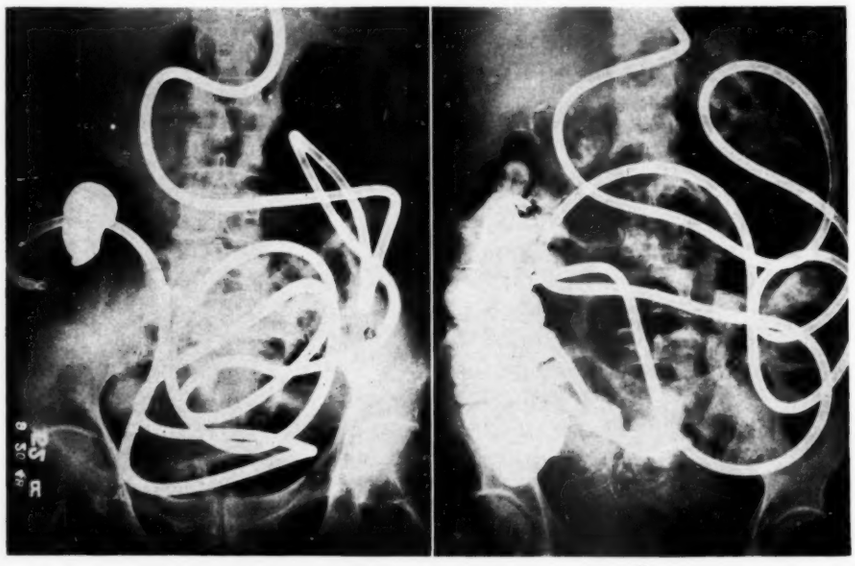

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FIG. 5. Radiograph of abdomen of patient with 6 feet of tube down the bowel; note tube head in the cecum.

FIG. 6. Radiograph of patient with 10 feet of intestinal tube down the gastrointestinal tract; note position of tube head as compared with Figure 5.

near the ileocecal valve. At times it passed through the ileocecal valve and passed along the colon—most commonly in the right colon. In a smaller percentage of cases the tube head valve and could be shown to be in the colon. Many such tubes had passed from the right colon into the transverse colon and descending colon. A small percentage of such tubes

FIG. 7. Ten feet of intestinal tube down the bowel; note condition of bowel at operation; plications very loose and peristalsis active.

emerged per anus. The number of cases in which this occurred was much the same as by the use of a 6 foot length of tube.

It was evident that there was little or no difference between the 6 foot tube and the 10 foot tube with regard to the distance along the bowel which had been traversed. The finding as shown by x-ray demonstrated the tube head to occupy essentially the same position regardless of the length of tube used, 6 foot or 10 foot. Figure 5 demonstrates the usual finding with 6 feet of tube down the bowel and Figure 6 demonstrates the usual finding with 10 feet of tubing down the bowel. Note that the tube head is essentially in the same position.

When the abdomen was opened in those patients in whom 10 feet of tubing had been permitted to pass, the findings were found to be markedly different from those cases in which 6 feet of tubing had been used. Whereas in the case of the 6 foot tube areas of loose plication alternated with areas of tight or moderate plication in which a decrease in peristaltic activity was shown, in the case of the 10 foot tube the bowel was found to be very loosely strung along the tube. The plication was barely evident being of such slight degree. Peristaltic activity was unimpaired. Peristaltic

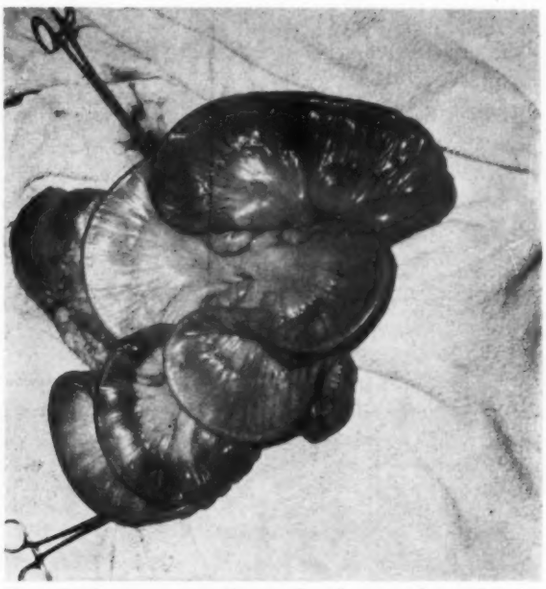

FIG. 8. Autopsy specimen showing 10 feet of tube passed down the bowel from stomach to cecum; note the looseness of plication and similarity to Figure 7 taken from a living patient.

waves could readily be demonstrated passing along the length of the bowel about the tube. Figure 7 taken at operation demonstrates the plication.

A long intestinal decompression tube was inserted through the stomach of a fresh autopsy specimen and passed along the small bowel to the ileocecal valve in an attempt to reproduce the clinical finding noted heretofore with regard to the plication. This was found to be quite easily accomplished. Note in Figure 7 that the bowel was very loosely plicated at operation and note in Figure 8 taken of the autopsy specimen that the same gross findings were present.

## SUMMARY

Although it has long been known that the small bowel pleats itself along the long intestinal decompression tube as it passes downward, no previous studies have been undertaken to demonstrate differences that occur by the use of different lengths of tube. The importance of such observations is that the optimum length of tube to be passed is that length which best decompresses the bowel and least interferes with the normal physiology of the gastrointestinal tract. This latter consideration is of the utmost importance if the tube is to remain within the bowel for any length of time.

Studying this problem by comparison between roentgen studies preoperatively and the finding at operation demonstrates that the shorter the length of tube down the bowel, the tighter the plication of the bowel about this tube. As a result of this there is the greatest impairment of peristaltic activity and the greatest decrease in absorptive area. The tighter the plication of the bowel upon the tube, the more prone is intussusception to occur.

A 6 foot long tube down the gastrointestinal tract appears to be far better than a 4 foot length of tube because the plication is much looser and peristaltic activity unimpaired to a great extent.

The 10 foot long tube results in the least interference with the normal physiology of the bowel. Peristaltic activity is unimpaired and the maximum area of mucosa is available for absorption and secretion. Intussusception is least likely to occur with this length of tube.

There is little point in pushing more than 6 feet of tube down the gastrointestinal tract if the bowel will not accommodate itself to this length of tube of its own accord. To do so merely results in looping of the tube within the bowel and knot formation. Emphasis is placed upon the point that the intestinal tube must not be fastened to the face of the patient. By leaving the tube free the swallowing acts of the patient, ambulation and the return of peristaltic activity usually result in the tube being slowly pulled down the gastrointestinal tract without being pushed by the surgeon. Such conditions are ideal because the bowel will only pull down sufficient tubing to which it can accommodate itself. A dependence upon the normal physiologic mechanism by which foreign bodies pass along the gastrointestinal tract results in the least interference with this mechanism. Looseness of plication of the bowel upon such tubes is the rule. In those cases in which the tube is fastened to the face and the intestinal musculature pulls upon the tube head against the resistance of it being fastened above plication is tight as a rule. The degree of plication depends upon the length of tube down the bowel. The shorter the length of tube the tighter the plication.

## CONCLUSIONS

1. The position of the tube head is extremely variable regardless of the length of tube down the bowel. The only accurate method of localization is by means of x-ray.
2. The intestinal decompression tube should never be fastened to the face of the patient.
3. Permitting the intestinal tube to pass downward only as fast as the peristaltic activity or pull of the tube head will allow results in the smallest degree of plication of the bowel and hence the least interference with the normal physiology of the bowel.
4. Six to ten feet of intestinal tube interfere least with peristaltic activity and produce the least plication.
5. In those cases in which the tube is to remain within the bowel for any length of time or is to be used for feeding a 10 foot length of tube is optimum because it results in the greatest surface area of mucosa being available for secretion and absorption and the least interference with peristalsis.

*Acknowledgment:* We thank Dr. Milton Darling, Dr. Charles Darling and Dr. Don McLean for permitting photographs to be taken with the abdomen opened during operation upon their patients.

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# ACUTE CHOLECYSTITIS*

## STUDY OF 140 CASES

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THE problem of acute cholecystitis and its management has long been a controversial one. The objective of this communication is to examine three aspects of this problem. First the incidence and significance of associated jaundice is to be considered, second the duration of the acute inflammatory process when it is not interrupted by surgery, and finally the all-important question of mortality. In studying the fatalities an attempt will be made to determine whether the mortality in this series of cases might have been lowered by earlier surgery.

### MATERIAL

The author studied the records of all patients with a diagnosis of acute cholecystitis admitted to the surgical service of the Long Island Division of the Kings County Hospital during the ten-year period from 1938 through 1947. During this period the general policy of the service in handling acute cholecystitis was to avoid surgery during the acute phase of the disease except in those cases in which the patients did not make satisfactory progress under expectant treatment and in those in which imminent perforation or the formation of a pericholecystic abscess were diagnosed.

Many of the cases reviewed in which surgery had not been undertaken and in which the patient made an uneventful recovery were of necessity rejected and not included in this series because the clinical evidence upon which the diagnosis was based seemed insufficient to establish the diagnosis beyond any doubt. Of the 140 cases comprising this report the diagnosis was established by operative and pathologic findings or by autopsy in fifty-five cases. The diagnosis in the remaining eighty-five cases was based on the presence of four or more of the criteria listed in Table 1.

*Jaundice.* A high incidence of jaundice complicating acute cholecystitis has frequently been reported. This has ranged from 10 to 25 per cent.[2,3,6,14,19] However, there have been fewer attempts to correlate the incidence of jaundice with the incidence of proven common duct calculus. Lester[14] reported an incidence of jaundice of 17 per cent but stones were removed from the common duct in less than one-third of these patients. Glenn[7] explored the common duct in 8.9 per cent of his patients with acute cholecystitis and found stones in 61.7 per cent of those explored.

TABLE 1

CRITERIA FOR DIAGNOSIS OF ACUTE CHOLECYSTITIS IN EIGHTY-FIVE NON-OPERATIVE CASES

| Basis of Diagnosis | No. of Cases |
|---|---|
| Typical pain | 85 |
| Right upper quadrant tenderness | 83 |
| Right upper quadrant muscle spasm | 62 |
| Palpable gallbladder | 43 |
| Fever over 100°F. | 84 |
| Leukocytosis | 71 |

Among our patients clinical jaundice or an elevation of the icterus index to 15 or higher was found in 30 per cent. No surgery was performed in half of these cases but the jaundice disappeared spontaneously and in no instance was one of these patients readmitted to Kings County Hospital with recurrence of jaundice at a later date. The other half of this group was subjected to surgery after the jaundice had subsided in all but one instance. The common duct was found to be dilated and was explored in eleven patients. However, stones were found in only four or 36.4 per cent of those explored. The important fact for consideration is that these four patients with proven stones in the common duct amount to only 9.3 per cent of the entire original group of patients with jaundice or elevated icterus index.

With the presence of stones demonstrable in less than 10 per cent of the patients with evidence of jaundice it would seem difficult to attribute the presence of jaundice when it occurs in acute cholecystitis to common duct

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stone in every case. One might theorize that when no stone is found at the time of surgery it has already passed along into the duodenum, or else reason, as do Colp and Lester,[5] that the common duct obstruction was due to some cause other than a calculus such as spasm of the sphincter of Oddi or inflammatory edema of the duct. However, another viewpoint is that jaundice in some cases should be attributed to associated hepatitis. Biopsy specimens taken from the liver at the time of surgery have shown an incidence as high as 87 per cent of hepatitis in acute cholecystitis.[10] However, the relationship of cholecystitis and hepatitis has been questioned by Colp[4] who took aspiration biopsies at a distance from the acutely inflamed gallbladder and found no changes in patients without jaundice and in those with jaundice only a focal liver cell degeneration representing a reaction to bile stasis.

TABLE II
DURATION OF ACUTE INFLAMMATORY PROCESS

| Interval between Onset and Operation | Average Duration of Normal Temperature Preoperatively | Percentage Still Having Acute Cholecystitis |
|---|---|---|
| Less than 3 wk. | 8 days | 100 |
| 3–4 wk. | 12 days | 73 |
| 1–2 mo. | 30 days | 66 |
| More than 2 mo. | 79 days | 50 |

The problem has also been approached by means of hepatic function tests. Thus a positive reaction to the colloidal gold test indicating hepatic disease has been demonstrated in a considerably higher percentage of patients with acute cholecystitis than in those with quiescent disease of the gallbladder.[1] Only thirty-two of our patients with acute cholecystitis had a cephalin flocculation test performed. However, in this small group the reaction was three or four plus in 31 per cent of the jaundiced patients but reached the same level in only 3 per cent of the non-jaundiced group. Even though the cephalin flocculation test may not be entirely reliable in cases of long-standing jaundice in differentiating between intrahepatic and extrahepatic causes,[16] the appearance of a strongly positive reaction in nearly one-third of the jaundiced patients tested points to the presence of hepatitis.

In view of the facts that stones are frequently found to be absent from the common ducts of jaundiced patients with acute cholecystitis and that there is a high incidence of elevated cephalin flocculation reactions in these cases it seems highly probable that jaundice may be produced by either an extrahepatic or an intrahepatic mechanism. However, no doubt remains that at the time of operation if jaundice is present or has been present the common duct should be carefully examined for evidence of stone or dilatation and should be explored or not on the basis of the operative findings.

*Duration of the Inflammatory Process.* A study of operative and pathologic findings in a group of patients undergoing surgery at variable intervals after apparent complete clinical subsidence of acute cholecystitis is of interest in determining how long a period of time is required after an attack of acute cholecystitis for the inflammatory process actually to subside. A review of the pathologic condition found in thirty-three of our patients helps to elucidate this problem. These patients underwent operation at a time when it was thought clinically that all evidence of acute cholecystitis had disappeared and many of them were readmitted for surgery long after their first admission for acute cholecystitis.

Hallendorf, Dockerty and Waugh[11] recently reported pathologic studies of gallbladders removed at intervals from one to thirty days after the onset of the acute attack giving a day-to-day picture of the progress of the pathologic condition. During the first week they found edema, venous congestion and extensive necrosis to be characteristic. By the fourteenth day edema and congestion were usually absent while cellular infiltration was moderate and massive fibrosis frequently replaced the tissue of the gallbladder wall. By the thirtieth day cellular infiltration was almost gone, fibrosis was extensive and moderate hemorrhage persisted in the wall of the gallbladder with subintimal edema of the vessels and micro-abscesses occasionally seen.

The acute inflammatory process in our patients persisted much longer than this in most instances and appeared to subside more slowly. The time interval from onset of acute cholecystitis to operation, the number of days of normal temperature, the absence of clinical findings preoperatively and the percentage of those still having acute cholecystitis on pathologic examination are summarized in Table II.

In those patients operated upon within three weeks of the onset the temperature had been normal on an average for eight days yet all were diagnosed pathologically as having acute cholecystitis. Edema and congestion were noted and one patient had a pericholecystic abscess walled off by omentum; in another a perforation was evident when the omentum was peeled off the gallbladder. Those operated upon between three to four weeks had had normal temperature for an average of twelve days but in only 27 per cent was the pathologic process quiescent enough for a diagnosis of chronic cholecystitis to be made. In the remainder edema, congestion and hemorrhage still persisted; two showed necrosis and one a perforation sealed off by omentum. The patients undergoing surgery between one to two months after onset had maintained a normal temperature for an average of thirty days preoperatively. However, one-third still showed edema, congestion and increased cellular exudate. An additional one-third were diagnosed by the pathologist as having acute cholecystitis and only the remaining third were found to be in the stage of chronic cholecystitis. Even the group which had gone more than two months since the onset of symptoms and with normal temperature averaging seventy-nine days showed a high incidence of a continuing acute process. There were only six patients in this group but three still showed edema of the gallbladder and in only two had the acute process entirely subsided. Of the whole group of patients operated upon when the condition was clinically quiescent operative and pathologic findings indicated quiescence in only 21 per cent.

It seems evident that the pathologic findings do not parallel the clinical in the apparent subsidence of acute cholecystitis and that edema, congestion and cellular infiltration may frequently persist for months after the onset of the acute process and long after the temperature and physical signs have subsided. This persistence of an acute process would suggest that there is little to be gained in the first three months at least by postponing surgery in the hope that the subsidence of edema and inflammation would make the procedure of cholecystectomy technically easier to accomplish.

*Mortality*. Of 140 patients there were nine deaths or a mortality rate of 6.4 per cent. Four of these deaths occurred in patients following surgery and five resulted in patients not subjected to surgery. These cases were studied to determine whether earlier surgery might have decreased the mortality rate. A brief summary of each case follows:

### CASE REPORTS

CASE I. A seventy-four year old man suffering with pain and vomiting of four hours' duration entered the hospital. The patient gave a history of no previous symptoms and complained of rigidity and tenderness over the right side of his abdomen and had fever and leukocytosis. On the day of admission a large subhepatic abscess was drained but the patient expired two days postoperatively. Autopsy showed acute cholecystitis with perforation, subhepatic and peritoneal abscesses.

CASE II. A seventy year old man with right upper quadrant pain and vomiting of forty-eight hours' duration gave a history of gallbladder symptoms for four years. The patient had jaundice, fever and abdominal tenderness. During the next ten days his temperature subsided and jaundice disappeared. At operation twenty-five days after admission perforations of the gallbladder were found sealed over by omentum. The common duct was not dilated and cholecystectomy was performed. He expired suddenly on the ninth postoperative day and at autopsy a pulmonary embolus was found.

CASE III. This patient was a forty-three year old man with right upper quadrant pain of one week's duration and a past history of gallbladder symptoms for one year. He was afebrile and his blood count was normal; x-ray examination showed a non-functioning gallbladder. With a preoperative diagnosis of chronic cholecystitis the patient underwent cholecystectomy seventeen days after admission. The operative and pathologic report was acute cholecystitis and cholelithiasis. His postoperative course was stormy and he died twenty-nine days after operation. At autopsy the patient was found to have diffuse purulent peritonitis and a subdiaphragmatic abscess.

CASE IV. A sixty-seven year old woman with right upper quadrant pain and fever of one month's duration was admitted to the hospital with a past history of gallbladder disease for one year. She had remained in bed one month prior to admission with almost

continuous pain, chills, fever and vomiting. She was very obese. Her gallbladder was palpable and tender, and fever and leukocytosis were present. The patient rapidly went downhill and died three days after admission without operation. No autopsy was performed.

CASE V. A forty-five year old man entered the hospital because of bilateral fractures of the head of the radius. He also complained of anorexia, vomiting, dyspnea and cough of five days' duration but had no abdominal pain. Abdominal examination revealed no abnormalities but the patient had fever and leukocytosis. While in the hospital he began to cough up bile and forty-one days after admission underwent exploratory laparotomy for bronchobiliary fistula. The gallbladder was acutely inflamed with an associated abscess which was drained. The patient died five days postoperatively and at autopsy a fistula was dissected out extending from the abscess through the diaphragm and into the right lower bronchus.

CASE VI. A seventy-four year old woman with abdominal pain and vomiting of four weeks' duration and a 15-pound weight loss was admitted. She had slight epigastric tenderness and an enlarged liver. Her white blood count was normal and the admission diagnosis was carcinoma of the stomach. At first she improved but ten days after admission vomiting recurred with right upper quadrant tenderness, jaundice, fever and leukocytosis. A diagnosis of acute cholecystitis was made but the patient died in two days without undergoing surgery. No autopsy was performed.

CASE VII. A seventy-one year old woman with vomiting of one week's duration and no bowel movement for eleven days was admitted to the hospital. She was irrational and dehydrated with distended abdomen, fever and leukocytosis. There was x-ray evidence of small bowel obstruction. The patient died before she could be put into satisfactory condition for surgery and at autopsy was found to have acute cholecystitis, a cholecystoduodenal fistula and gallstone obstruction of the small bowel.

CASE VIII. A seventy-eight year old woman with right upper quadrant pain of forty-eight hours' duration entered the hospital giving a history of gallbladder symptoms for one year. Right upper quadrant spasm and tenderness were present with fever and leukocytosis. For eleven days the patient appeared to be improving but then she had a sudden rise in temperature with a return of acute abdominal signs. She died within forty-eight hours and no autopsy was obtained.

CASE IX. A fifty-nine year old woman with epigastric pain and vomiting of four days' duration was admitted to the hospital with a past history of acute cholecystitis six months previously. Moderate tenderness and muscle spasm were noted in the right upper quadrant. Her temperature and blood count were normal on admission but in two days became elevated with the appearance of abdominal distention and generalized tenderness. The patient was considered to have diffuse peritonitis. She died on the eighth day after admission. No autopsy was obtained.

## COMMENTS

Our total mortality rate of 6.4 per cent might be compared with the rates reported from other clinics which range from 2.4 to 10 per cent.[6,7,12–15,17,18,21,22] However, a mortality rate in itself has little meaning without reference to the type of cases included in the report. In this series in which many of the patients were not subjected to surgery the necessity of setting up sufficiently rigid diagnostic criteria for includion of cases in the report tended to exclude many of the milder cases. Had these patients been operated upon and the diagnosis established on a pathologic basis they might have been included and this could possibly have reduced the mortality rate.

The factor of age is also exceedingly important as emphasized repeatedly in the literature.[6–9,20] The mortality in the older age group is so much higher in acute cholecystitis that no mortality rate has much meaning without reference to the age of the patients under consideration. This is borne out in our cases in which six of the nine fatalities were in patients over sixty-five years of age. Thus with an over-all mortality rate of 6.4 per cent the mortality for those under sixty-five was only 3 per cent whereas for those over sixty-five it approached 17 per cent.

A much more accurate appraisal of the results of treatment may be achieved through a study of the individual records of the patients succumbing to the disease, with evaluation of the factors which might have been altered to bring about a more favorable result. Three such factors deserve consideration: (1) Evidence of a long-standing gallbladder disease before the acute attack and the advisability of elective cholecystectomy during this period of fore-

warning to avoid the dangers of the acute attack; (2) jeopardy to the patient's chances of recovery by delay in bringing him to the hospital for surgical observation and treatment; (3) possibility and benefit of an earlier operation within forty-eight hours after admission to the hospital.

It has been noted frequently that previous symptoms of gallbladder disease antedate the acute attack in a large proportion of cases.[2,3,6,14] This has also been found to be true in our cases in which a history of pre-existing gallbladder disease was found to be present in 71 per cent of all the patients. On examining the protocols of the fatal cases it is evident that five of nine gave a definite history of gallbladder disease from six months to many years before the onset of acute symptoms. Therefore, the incidence and mortality of acute cholecystitis may be significantly reduced by early diagnosis of and surgery for gallbladder disease before the condition has the opportunity to progress to the acute stage.

The factor of delay in bringing the patient to the hospital for surgical observation and treatment is also of significance in increasing the mortality rate. In the entire series 21.4 per cent of the patients were admitted to the hospital one week or more after the onset of acute cholecystitis. This delay appeared to play a role in three of the fatal cases but is most clearly demonstrated in Case IV in which a woman was allowed to remain at home acutely ill for one month and was finally brought to the hospital in a terminal condition to die shortly after admission. Patients with acute cholecystitis should certainly never be treated at home.

The factor of an early operation within forty-eight hours after admission to the hospital was also studied in the protocols of the fatal cases. In these first seven cases it is thought that no change in the plan of treatment would have been likely to alter the outcome. In Case I the patient was subjected to immediate surgery on admission. In Case II the patient was operated on long after admission but his postoperative course was uneventful until sudden death shown at autopsy to be due to pulmonary embolus. In Case III the patient was considered to have chronic cholecystitis and showed no preoperative evidence of acute cholecystitis for which earlier surgery might have been performed. In Case IV the patient had been ill and bedridden for one month prior to seeking medical aid and died soon after admission offering no opportunity for early surgery. In Case V the patient entered the hospital for entirely unrelated injuries and the first evidence of the gallbladder perforation came with the appearance of a bronchobiliary fistula, death following operation. In Case VI the patient presented very atypical symptoms more suggestive of carcinoma of the stomach and no diagnosis of acute cholecystitis was made until, apparently, perforation and peritonitis had occurred. In Case VII the patient entered with intestinal obstruction and died very shortly afterward from the effects of gallstone ileus.

In the last two cases reported (Cases VIII and IX) in which the patients were admitted to the hospital with a history of only two and four days' duration, respectively, a diagnosis of acute cholecystitis was made on admission. Had these patients been subjected to early surgery they may well have survived as the course of the illness suggests free perforation of the gallbladder with diffuse peritonitis appearing on the eleventh and second day of hospitalization, respectively. If these two patients had been operated upon and survived, the mortality in this series would have been lowered from 6.4 to 5.0 per cent. Whether this could have been achieved in actual practice is a moot question in view of the fact that had all patients been operated upon indiscriminately several, especially in the older age group, who survived without surgery might have succumbed following the operative intervention thus wiping out the potential gain. Therefore, it would seem that some latitude should be given the surgeon to individualize the therapy in any given case of acute cholecystitis and to attempt an appraisal of the various factors in each case which might give the patient a better chance with or without early surgery. It is conceded that poor surgical judgment may have been used in the last two cases discussed. However, to operate early upon all patients indiscriminately is to deny the value of surgical judgment altogether as to the outcome in acute cholecystitis as we do in acute appendicitis. Indeed, the two conditions have been compared and the urgency of surgery has been considered as great in one as in the other. This would be valid if the incidence of free perforation and general peritonitis were equal in both and if these ailments appeared in individuals presenting comparable operative risks. However, free perforation and diffuse peritonitis is considerably less frequent in acute cholecystitis and the operative risk in healthy,

young individuals afflicted with acute appendicitis is hardly to be compared with that for patients in the older age group with acute cholecystitis who are likely to be obese and arteriosclerotic. Therefore, it is the opinion of this writer that when acute cholecystitis appears in a relatively young individual in good physical condition cholecystectomy should be carried out as soon as possible after admission to avoid complications and prolonged morbidity. However, it is also believed that in the older age group there is still room for the exercise of judgment as to when and whether to operate based on the findings of this study in which mortality could be attributed to delay in operation following hospital admission in only a very small percentage of the cases.

## SUMMARY AND CONCLUSIONS

1. A series of 140 cases of acute cholecystitis practically none of which were subjected to early surgery is analyzed and the diagnostic criteria used in the unoperated groups are enumerated.

2. The incidence of jaundice in acute cholecystitis is high. However, in view of the fact that without surgery the jaundice usually subsides and that at operation stones are not found in the common duct in a considerable percentage of patients it seems likely that jaundice in acute cholecystitis may be due in many cases to hepatitis rather than to common duct obstruction.

3. Acute cholecystitis may require many months to subside as judged by the pathologic findings at delayed operations despite the fact that the patient may long have been afebrile and free of any symptoms.

4. An overwhelming majority of patients with acute cholecystitis give a previous history of gallbladder disease. Therefore, many cases of acute cholecystitis could be eliminated by performing cholecystectomy before the acute attack strikes.

5. Many of the fatalities may be attributed to delay in bringing the patient to the hospital for treatment.

6. The mortality in this series of cases was 6.4 per cent and careful study of the deaths indicates that it could not have been reduced below 5.0 per cent had all patients diagnosed as having acute cholecystitis been subjected to earlier surgery. It is believed that this potential margin of improvement is so small that it might well be counterbalanced by increased operative mortality in the older, poor risk patients. Therefore, the need to individualize the treatment to suit the patient is stressed.

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# RECTAL SARCOMA AND ANORECTAL MALIGNANT MELANOMA*

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SINCE Rokitansky separated sarcomas from supposed carcinomas in 1885 and Kundrat distinguished lymphosarcoma from other types of pathologic diseases of lymphatic structures in 1893, sarcoma of the rectum has been found to be a rare entity.

Guret[14] found only three cases of sarcoma of the rectum in a series of 840 cases of sarcoma. Nothnagel reported on 274 patients with sarcoma operated upon in Vienna with only one lesion located in the rectum. Hochenegg during the years 1900 to 1907 operated upon some 500 patients with malignant tumors of the rectum, of which two were sarcoma and two were malignant melanomas. Dukes and Bussey[9] identified eight cases of sarcoma of the rectum from 2,200 operative specimens of rectal malignancies collected over an eighteen-year period at St. Marks Hospital, an incidence of approximately 0.5 per cent.

In 1927 Weeks[24] reviewed the literature and found 100 cases of sarcoma of the rectum. At that time he stated that if doubtful cases were excluded probably only fifty cases of true primary sarcoma of the rectum would remain. Week's statistics showed that one rectal sarcoma was found in every 242 cases of sarcoma. In every 200 cases of malignant diseases of the rectum there were 199 cases of carcinoma and only one case of sarcoma. The literature from 1927 to 1945 presents only fifty additional cases of sarcoma of the rectum according to Goldman and Marbury.[13] In a review of the literature from 1945 until the writing of this paper the authors have found six additional cases[1,10,15,19,21,22] totaling 156 reported cases of sarcoma of the rectum.

*Classification.* Sarcoma, a malignant tumor of mesenchymal tissue origin, is classified according to the tissue from which it originates. According to Moore[18] malignant tumors of the mesoderm may be classified histogenically or cytologically. The histogenic classification is the better of the two since the behavior of a tumor and the prognosis for the patient depend on the biologic potentialities of the cell and not on its shape. Thus sarcomas of the rectum are classified as follows: (1) fibrosarcoma, (2) myxosarcoma, (3) liposarcoma, (4) angiosarcoma, (5) lymphosarcoma and (6) myosarcoma.

Most investigators find sarcoma of the rectum more prevalent in the male than in the female; the incidence is often given as a ratio of 2:1. Some authors[13] describe a ratio as high as 5:1. In our series there are two cases of malignant melanoma and nine cases of sarcoma of other types. The distribution of cases according to sex is a ratio of 6:5, yet with the exclusion of the controversial melanomas the ratio is 4:5.

*Symptomatology.* The symptoms of rectal sarcoma are by no means characteristic. Rectal bleeding, cachexia with rapid loss of weight, urgency for stool, unsatisfactory evacuation and a sensation of "fullness and heaviness" in the rectum are often described by the patient. There may be tenesmus, especially when the mass invades or impinges on the sensitive anal canal. The pain may be enhanced during defecation; diarrhea and constipation are not uncommon; occasionally there is a protruding and receding mass during defecation. The appearance of a foul-smelling discharge consisting of pus, mucus and blood usually denotes ulceration of the overlying mucosa and is a late manifestation of sarcoma of the rectum.

*Diagnosis.* The diagnosis is made by biopsy, operation or autopsy. The first clinical indications of sarcoma may be one or more nodules located in the bowel wall over which the mucosa may be felt to slide. As the nodules increase in size, they assume a consistency dependent upon their cell structure. The fibrosarcoma is hard and nodular whereas the lymphosarcoma is soft and has been described as a velvety mass pressing on the lumen of the bowel. In general, the more cellular the neoplasm the softer is its consistency. The lesion becomes progressively larger and frequently

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erodes through the mucosa. Not all sarcomas are confined to the rectal wall; occasionally the lesion is polypoid. Pigmented lesions should always be carefully studied to determine the presence or absence of a malignant melanoma. In some instances a very cellular lesion will necrose and become cystic. This particular condition might even impart the sensation of fluctuation upon examination. Kallet[16] describes a case of sarcoma of the rectum that featured a rather fluctuant, granulomatous mass which when incised discharged a grumous, sanguineous fluid containing fleshy particles.

Sarcoma of the rectum should be differentiated from adenocarcinoma of the rectum and also from rectal lesions due to lues, lymphogranuloma venereum, tuberculosis and chronic pyogenic infections. There are also certain benign tumor masses from which sarcoma must be separated, chiefly adenomas, lipoma, pararectal and submucosal nodules secondary to injection treatment and thrombosed internal hemorrhoids. In distinguishing sarcoma from adenocarcinoma of the rectum it will be noted that similar symptoms may prevail. However, it is the general concensus that cachexia is more rapid in patients with sarcoma as a result of early metastasis by the blood vessels to the lungs, liver and even the heart muscle. Adenocarcinoma due to its mucosal origin ulcerates earlier to give rise to a foul discharge of blood, mucus and pus. Syphilitic gummas are hard, oval, painless lesions diagnosed with the aid of serologic tests. Patients with lymphogranuloma venereum frequently give a history of buboes, and the female patients occasionally have rectal strictures. There is also an increase in total serum protein, especially the globulin fraction. The diagnosis is further aided by utilization of the Frei test. Patients with anorectal tuberculous lesions usually have tuberculosis elsewhere. Chest x-rays and tuberculin tests are an aid here. Gabriel[12] points out that a chronic type of rectal submucous abscess with thick, indurated walls may simulate sarcoma, but careful examination will disclose a central softening and possibly a small submucous sinus at its lower end which may admit a probe and discharge pus. Adenomas are soft and elastic mucosal tumors attached to the mucosa by a broad base or by a pedicle if it is polypoid. An induration of an adenoma should be looked upon with suspicion as being malignant. A rectal lipoma is a soft, pliable submucosal tumor. Small, hard submucosal or pararectal nodules are frequently the result of injection therapy for internal hemorrhoids. Internal thrombosed hemorrhoids are globular swellings, usually multiple in quadrants which occur within 1 inch above the anorectal line. They tend to protrude, are quite painful and are prone to bleed at time of, or following, stool. It is mandatory that all lesions of the rectum be biopsied. Buie[8] in discussing this problem of diagnosis of sarcoma of the rectum remarks, "If there is a fact that speaks loudly in favor of taking specimens for microscopic examination in the course of proctoscopy, it is the impossibility of diagnosing sarcoma in any other manner."

*Treatment.* Early and radical extirpation is the recommended treatment for all types of sarcoma of the rectum. If it is impossible to remove all of the malignant tissue, radiotherapy may be instituted in cases of lymphosarcoma and liposarcoma. Inoperable cases of these two types of sarcoma may also be benefited by irradiation. All other types of sarcoma as well as malignant melanomas are so radioresistant that many radiologists believe that radiotherapy is of no real value. For those lesions which involve the anal canal an inguinal node dissection is recommended two weeks following the radical procedure for removal of the rectum.

*Malignant Melanoma.* Classification of the malignant melanoma is difficult. Masson[17] has shown that histogenically certain of the pigmented tumors arise in relationship to the neuroepithelial derivatives of the end organs. Una[23] describes them as arising from the stellate cells, the Langerhans cells of the basal layer of the epidermis; thus he considered all melanomas to be carcinomas. Ewing[11] supported Ribbert's theory that they originate from the chromatophore, a specific mesoblast cell. Many have come to the support of each of these investigators. Malignant melanomas through the years have been placed in two major groups: the melanosarcoma in which there is a predominance of spindle cells, and the melanocarcinoma in which there is a predominance of large polyhedral cells. Today it is recognized that both cell types may exist side by side within the same malignant melanoma. Although malignant melanomas of the anorectum usually arise in the anorectal canal and gradually invade the rectal mucosa, at least

one case has been reported as occurring primarily in the rectosigmoid.[6] These tumors may be sessile or pedunculated. (Kallet and Saltzstein[16] reported a case in which a malignant melanoma developed in a rectal polyp.) In general, they are irregular in shape and dark brown or black in color due to the pigment melanin. A certain number produce scant or no discernible pigment. However, the metastases are always deep black in color.

In our group there were two anorectal malignant melanomas which were reported by one of the authors in conjunction with Pena.[3] Both patients were white men seventy-two and sixty-one years of age, respectively. The former lived six months following operation and the latter, one year and one month.

*Types of Rectal Sarcoma Included in This Survey.* Fibrosarcoma or spindle cell sarcoma is characterized by varying amounts of fibrous tissue. This tumor is often nodular, hard and sessile. Frequently it grows to huge proportions and may obliterate the rectal lumen. There have been three of these sarcomas on our service. One, a sixty-one year old white woman, is untraced. A sixty-nine year old white woman lived three years and eight months following surgery. The third case, that of a sixty-one year old white woman, is interesting because she is living and well at this writing, a period of four plus years. (Table 1.)

Neurogenic sarcoma is a type of fibrosarcoma arising from the nerve sheath. At first it is localized but frequently following surgery it recurs and metastasizes to the lungs. There is one case to represent this type; namely, that of a fifty year old white woman who lived one year and eight months following extirpation of the lesion.[2]

Lymphosarcoma is a highly malignant tumor originating in lymphoid tissue. According to Ewing it is derived from proliferation of atypical lymphocytes. A localized or diffuse mass may be present and the mucosa at that time may be pale and move freely over the mass. Progressively over a period of time the mucosal surface is thrown into folds or convolutions. Later the lesion becomes definitely diffused; the folds become more prominent and finally resemble the convolutions of the cerebellum. The rectal mucosa often assumes a deep red color. Some patches of white exudate may appear and occasionally there is some ulceration.

There are two cases of lymphosarcoma in this series. One case has been reported.[2] The case report of patient E. L. is presented in this article. A thirty-five year old white male who was operated upon in 1947 was alive and well at the time of the present writing.

Reticuloendothelial sarcoma is usually considered a form of lymphosarcoma (reticulum cell lymphosarcoma or large round cell sarcoma). It is highly malignant. Boyd[7] states that is a more common lesion of the lymph nodes than pure lymphosarcoma. The cytoplasm of the reticulum cell is usually abundant and acidophyllic. The nucleus is about twice the size of that of the lymphocyte. Characteristic is the presence of pseudopod-like processes of the cytoplasm and nuclear material suggesting ameboid activity of the cell. These pseudopodia encircle other cell groups and the tumor cells may often be seen infiltrating blood vessels.

TABLE 1
AUTHORS' SERIES

| Patient | Age | Sex | Type | Treatment | Survival |
|---|---|---|---|---|---|
| J. W. | 72 | M | Malignant melanoma anal canal | Extirpation | 6 mo. |
| A. B. | 61 | M | Malignant melanoma anorectum | Extirpation | 13 mo. |
| M. F. | 57 | F | Fibrosarcoma | Extirpation | Alive and well since 1946 |
| F. G. | 64 | F | Fibrosarcoma | Extirpation, irradiation | Not followed up |
| C. E. | 69 | F | Fibrosarcoma | Extirpation, irradiation | 3 yr., 8 mo. |
| F. D. | 58 | F | Neurogenic sarcoma | Extirpation | 1 yr., 8 mo. |
| G. R. | 47 | M | Leiomyosarcoma | Extirpation, irradiation | 1 yr., 6 mo. |
| F. L. | 51 | M | Leiomyosarcoma | Extirpation | Known to have lived 2 yr. plus |
| G. D. | 3⅔ | M | Reticuloendothelial sarcoma | Extirpation, irradiation | 1 yr., 4 mo. |
| A. H. | 35 | M | Lymphosarcoma | Extirpation | Alive and well since Mar., 1947 |
| E. L. | 48 | F | Lymphosaroma | Extirpation | Alive and well since Oct., 1949 |

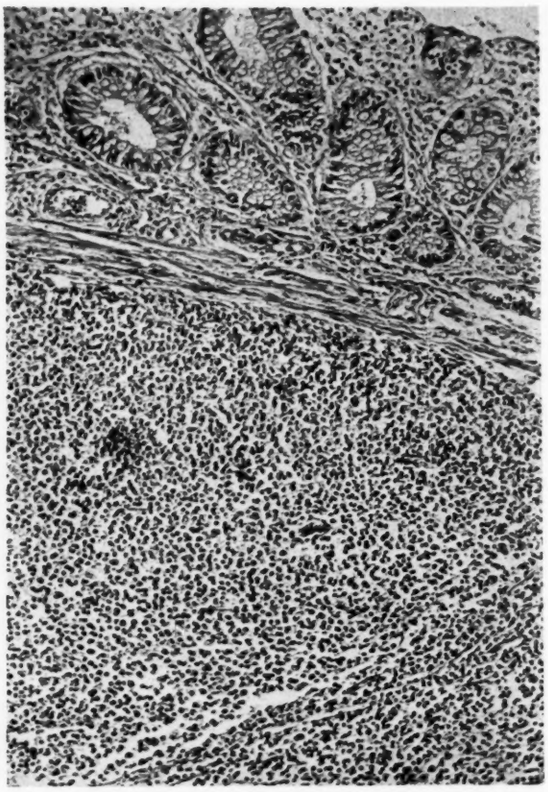

FIG. 1. Microscopic view demonstrating an intact mucosa and muscularis mucosa. The submucosal layer is considerably widened as a result of neoplastic proliferation of lymphoid elements, which are predominantly of the adult lymphocytic type. In another section definite invasion of the wall was noted thus attesting to the malignant status of the lesion.

There is one case to represent this type of lymphosarcoma. A boy three years and eight months of age lived only one year and four months after extirpation and irradiation. This case was reported by one of us with Sealy[5] in 1939.

Leiomyosarcoma originates in the smooth muscle of the bowel wall. The clinical characteristics are no different from the other types of sarcoma. Rankin and Larson[20] reported four cases of rectal leiomyosarcoma in 1932, which is the largest series reported. One of the authors with Scheffler[4] reported a case in 1941. This patient survived one year and six months following extirpation and irradiation. An additional case was also reported from this service. The patient was a fifty-one year old white man who was known to have survived two years following removal of the tumor.[2]

Myxosarcoma, liposarcoma and angiosarcoma are malignant neoplasms of myxomatous tissue, adipose tissue and blood vessels, respectively. We mention them only to report that we have had no cases of these three types of sarcoma.

## CASE REPORT

E. L., a forty-eight year old white woman, underwent a hemorrhoidectomy in another city, at which time a small nodular mass was discovered in the rectum. Tissue was taken for microscopic study which revealed lymphosarcoma. The patient was referred to us for resection even though she presented no symptoms. The past history was irrelevant except for a panhysterectomy in 1947.

Physical examination was essentially normal except for the abdominal wall which revealed a well healed suprapubic surgical scar. By palpation of the rectum there was a small nodular mass on the left anterolateral wall 5 cm. above the pectinate line. A barium enema revealed no additional colonic pathologic condition. All laboratory procedures were within normal limits.

On October 20, 1949, we performed an abdominoperineal resection of the Miles type with pelvic node dissection and excision of the posterior vaginal wall. The postoperative course was uneventful and the patient was discharged on October 30th.

The pathologic report revealed the following: Sections taken through the segment of bowel designated sigmoid showed nothing of significance. Those taken through the plaque of tissue in the lower portion of the rectum disclosed a large mass of lymphoid tissue occupying the submucosa. There was invasion by the mass of tumor cells into the deep structures of the wall and subserosal tissues. (No tumor cells could be definitely proven in any of the remaining specimen submitted.) The diagnosis was lymphosarcoma (lymphocyte type) of the rectum. (Fig. 1.)

This patient has since been examined periodically and no residual tumor has been found.

## SUMMARY AND CONCLUSIONS

1. Rectal sarcoma and anorectal malignant melanoma are known to be rare tumors.

2. The authors have presented nine cases of rectal sarcoma and two cases of anorectal malignant melanomas.

3. Three of these patients are alive and well at the present writing: (1) a sixty-one year old

white woman from whom a fibrosarcoma was radically removed in April, 1946; (2) a thirty-five year old white man who has survived extirpation of a lymphosarcoma done in March, 1947; (3) a forty-eight year old white woman upon whom resection for lymphosarcoma was performed in October, 1949.

*Acknowledgment:* The authors with to acknowledge the assistance and cooperation of Doctors E. S. Gault and A. R. Peale, Department of Pathology, Temple University Medical School, in the preparation of the photomicrograph.

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# THE RATIONALE OF PROSTATECTOMY*

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THE young doctor is amazed at the great diversity of informed opinions which exist regarding the management of the obstructing prostate. A new procedure is devised and shortly thereafter numerous reports appear in the literature of long series of cases with little or practically no mortality or morbidity. Such should indicate the advent of the perfect operation. However, within a few years another type of approach replaces that one in popularity. No operation in the realms of surgery has a more vigorously divided group of advocates than the four types of operation on the prostate gland. Each has its place, and the urologist should be familiar with all and select the one that is most suitable to the patient's condition. The accuracy of statistics depends upon the reporter; complications are frequently overlooked or minimized due to poor follow-ups. Apparently technic alone, rather than anatomic and physiologic fundamentals, has been featured by those who advocate that a urologic surgeon limit his practice to one of the stereotyped procedures.

There are only two reasons for performing a prostatectomy: (1) relief of urinary obstructions and (2) cure of early cancer of the prostate. In the final analysis the surgeon asks himself whether if he were the patient he would have the operation performed; and we must not forget that very few urologists have had prostatectomies. Morbidity not mortality is of primary interest.

Benign hypertrophy of the prostate is undoubtedly due to endocrine imbalance since it develops only in those who have testicles. It is regarded by some as a true adenomatous tumor and others as a senile hyperplasia of the normal elements of the prostate. From the standpoint of the surgeon the matter is wholly academic. Too often the bad operative results are directly due to abysmal ignorance of anatomy.

Fundamentally the prostate is the muscular neck of the bladder which has been invaded by gland tubules. (Fig. 1.) The prostate consists of an extension of the two layers of smooth muscle fibers of the bladder wall which have been invaded by prostatic gland tubules. It has two "sphincters," one proximal and the other distal. A true sphincter is a muscle whose origin and insertion is in itself. Hence the bladder has a true external sphincter made up of striated muscle fibers but there is no true internal sphincter. The term is merely a surgical designation and does not refer to an anatomic entity.

The bladder has an internal circular and an external longitudinal layer of smooth muscles which are not perfectly defined. The vesical orifice is closed by two loops or arcs of smooth muscle fibers, one arising from the internal circular layer, commonly designated as the internal arcuate muscle of the vesical orifice, and the other from the external longitudinal layer of the bladder wall or the external arcuate muscle of the vesical orifice. (Fig. 2.) Fibers of the internal circular layer form a loop about the urethra. From the region posterior to the vesical orifice they swing downward and forward in an oblique direction, passing as thin bands inside the loop of the external longitudinal muscles heretofore described and around the urethra in the region generally opposite the verumontanum where they form an arc in front of the urethra. The action of the so-called internal sphincter is due to the tonsillotome-like contraction of the two loops.

In the base of the bladder there is in addition the trigonal muscle. It is a continuation of the external longitudinal layer of the two ureters that interlace and flow downward through the internal vesical orifice to the verumontanum. The external longitudinal and internal circular layers arise from tissues of entodermal origin whereas the trigonal muscle is of mesodermal origin.

Some of the fibers of the external longitudinal layer pass down along the posterior surface of the bladder until they reach the region of the trigone. There they sweep up toward the vesical

* Read at Riunioni Medico-Chirurgiche Internazionali, I Mostra Internazionale delle Arti Sanitarie, Riunioni di Urologia, Torino, Italy, June 6, 1951.

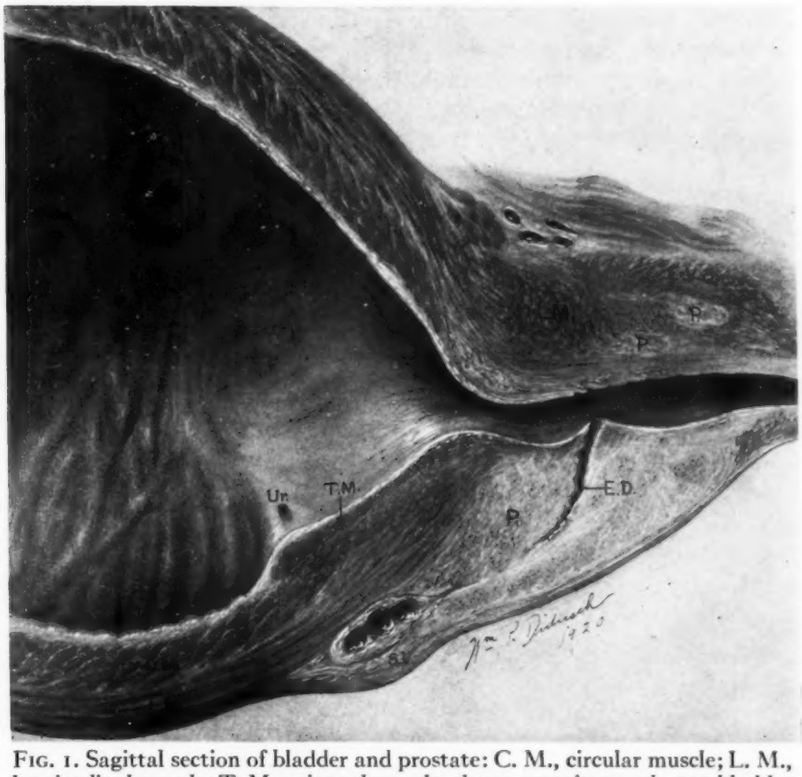


FIG. 1. Sagittal section of bladder and prostate: C. M., circular muscle; L. M., longitudinal muscle; T. M., trigonal muscle, shown superimposed upon bladder muscle; Ur., ureter; E. D., ejaculatory duct; S. V., seminal vesicle; P, prostatic gland tissue; E. V. S., external vesical sphincter. The arc-like course of the trigonal muscle which passes down the floor of the urethra is shown.

orifice, becoming more compact and intermixed with elastic tissue, pass on through the circular layer and are lost in its depth. The contraction of these longitudinal fibers at time of voiding undoubtedly pulls the posterior lip downward and helps open the "internal sphincter." However, a portion of those fibers which range along the back of the bladder diverge slightly to form muscular bands which pass forward and downward on either side of the vesical orifice. At the upper level of the urethra these two bands swing medially and unite to form a loop or arc above the urethra. The fibers pass freely through this loop and there is no raphe formation. The longitudinal fibers which sweep down the anterior surface of the bladder for the most part end at the vesical orifice, but a few pass along the anterior aspect of the prostatic urethra just beneath the mucosa and form an internal longitudinal layer of the urethra corresponding to the trigone fibers of the posterior aspect.

Over the prostate lying close to the bladder is a saddle of striated muscle fibers. These fibers may be found at a point anterior and distal to the vesical orifice lying in close relationship to the fibers of the loop of the external longitudinal muscles and are often quite close to the urethral mucosa and even lie between the prostatic tubules. As they proceed downward and forward, they increase in number until at a point below the border of the loop from the internal circular layer they pass in front of the urethra and form a layer of striated fibers running in a direction generally circular with regard to the urethra but extending only about halfway around it. However, further down at a point opposite the apex of the prostate they join those from the opposite side in a raphe thus forming from this point onward a complete circular sheath about the urethra. This system of striated muscle makes up the external bladder sphincter—a true sphincter. The raphe joins with an extension from the external longitudinal fibers of the rectum to form the rectourethralis muscle.

It has been frequently demonstrated by clinical studies and cystography that the in-

ternal sphincter, although made up of smooth muscles, is not in a strict sense an involuntary muscle but is capable of giving voluntary control of urination when there has been complete destruction of the external sphincter. However, Within a few months following extirpation of the "benign prostatic hypertrophy" the compressed prostatic tissue resumes its usual size and shape and the gland then appears to be normal.

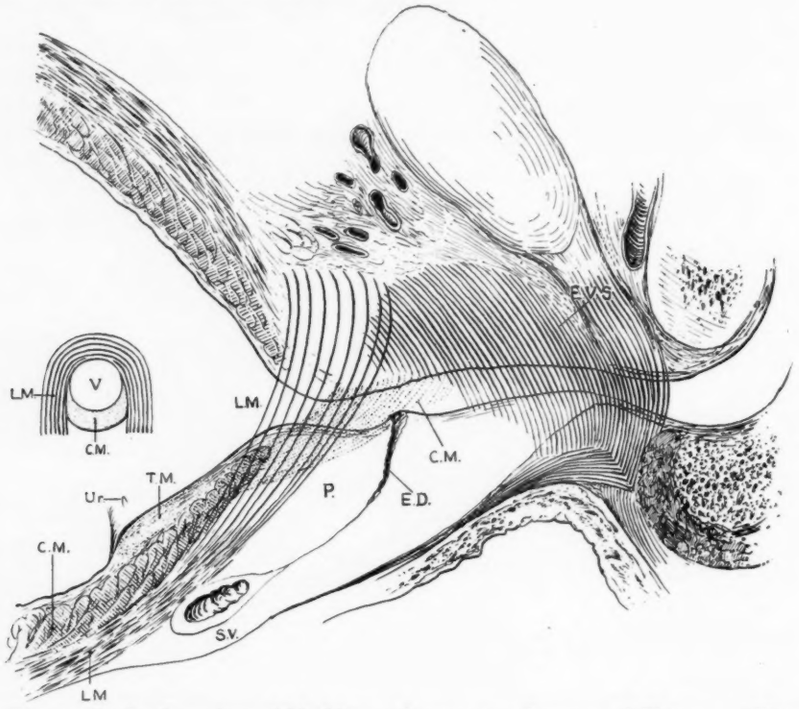


FIG. 2. Sagittal section of bladder and prostate; diagram of Figure 1: (The bladder was bisected, one-half being cut into serial sections and from tracings of projections on glass plates that were stacked and illuminated so as to show in three dimensions the course of the muscles reproduced.) The external longitudinal layer of the base sweeps up over the vesical orifice, making a loop. Within this loop the circular layer forms a wedge below the orifice and flows down the urethra in an oblique direction surrounding the canal as a thin layer. The result is a double loop and not a sphincter. The small insert is a cross section of the vesical orifice showing the upward pull of the loop from the circular muscle and the opposing action of the longitudinal muscle loop. At apex of prostate the raphe of the external sphincter of striated fibers is seen to join with rectourethralis muscle between the bulb and rectum. V., vesical orifice; L. M., longitudinal muscle; C. M., circular muscle; T. M., trigonal muscle; E. V. S., external vesical sphincter (striated muscle); Ur., ureteral orifice; S. V., seminal vesicle; E. D., ejaculatory duct; P., prostate.

the muscle fibers of the posterior urethra undoubtedly play a part in helping close the bladder orifice.

The prostate has a fibrous capsule that surrounds and encloses the structure. In cases of benign hypertrophy the term is broadly used to include not only the true prostatic capsule but also the compressed normal prostate and scar tissue that lie internal to the capsule, which wholly or in part enclosed the tumor growth.

Prostatectomy is an inexact term for it is usually applied not to the removal of the prostate but to an abnormal growth in the prostate.

The "prostate lobes" removed at operation consist of a growth arising in the mucosal or suburethral glands in close relationship with the urethra. They are enclosed in a fibrous layer that separates the tumor from the normal prostatic tissue, compressed against the true fibrous capsule. The mucosal glands which undergo hypertrophy are practically always between the verumontanum and the bladder. Hence the verumontanum lies between the apex of the hypertrophy and the membranous urethra, and the ejaculatory ducts are outside the hypertrophied masses.

What is designated as the posterior lobe of the prostate is merely the posterior lamella containing the ejaculatory ducts, distended and thinned out by the growth of the hypertrophied masses. However, there may be isolated spheroids of hypertrophy in this so-called posterior lobe, and in these 75 per cent of the cancers develop.

Usually the hypertrophy originates in the submucosal glands along the prostatic urethra anterior to the verumontanum, becomes very large, elongates anteriorly and posteriorly and causes little or no obstruction except by compression of the urethra.

If the growth develops near the vesical orifice, it may undermine and pass beneath the "internal sphincter" and push up the trigone, forming a middle lobe which may attain an enormous size and cause few or no obstructive symptoms. However, if instead of passing beneath it bulges through the "internal sphincter" beneath the mucous membrane, Albarran's lobe is formed; such although very small may have a ball-valve action and result in complete urinary obstruction.

Tumors of the submucosal glands are usually separated from the prostate by a partial or complete fibrous capsule. If the surgeon in his enucleation closely follows this fibrous capsule or so-called line of cleavage, he will avoid the verumontanum, ejaculatory ducts and the normal prostatic tissue and relieve the obstruction without damaging the patient's potency and urinary control.

*Indications for Surgery.* In the absence of complete retention the criterion for operation is not the amount of urinary residual but rather the damage to the upper urinary tract as demonstrated by excretory urography. Of course, the presence of such complications as stones and diverticula has to be taken into consideration.

## OPERATIONS

To relieve prostatic urinary obstruction there are four well recognized methods of approach: (1) perineal, (2) suprapubic, (3) retropubic and (4) transurethral. Each has its indication and anatomic pitfalls.

*Perineal Prostatectomy.* This is the logical method in cases of extravesical lateral lobe enlargement. The operator must be as familiar with the anatomy of the perineum, and particularly the rectourethralis muscle, as he is with his living room in the dark; otherwise one is reminded of the mythologic Scylla and Charybdis. If he goes too far forward, the triangular ligament is opened above the transverse perineal muscle and he is hemmed in laterally by the pubic arch; and in trying to reach the prostate he cuts into the bulb with resultant hemorrhage that is difficult to control.

Eventually he damages the external sphincter and urinary incontinence ensues. If the operator fails to cut the rectourethralis muscle and blindly follows it posteriorly, he is finally led into the rectum with a resultant rectourethral fistula. A timid surgeon who makes first one and then the other of these mistakes never again attempts this simple and logical approach to the prostate.

The anatomy is simple. The rectourethralis muscle is formed by a bundle of muscle fibers arising from the anterior thickened longitudinal band of the rectum at the level of the verumontanum that passes forward and fuses with the raphe of the striated external vesical sphincter. It is responsible for the acute anterior flexure of the rectum and holds it in close approximation to the apex of the prostate. If the operator properly exposes the central tendon at its juncture with the transverse perineal muscles and divides it close behind the bulb, the rectourethralis muscle quickly comes into view. It is divided; then the posterior layer of Denonvilliers' fascia is incised and the rectum immediately falls back exposing the prostate covered by the shining anterior layer of Denonvilliers' fascia.

In early embryonic life the peritoneal cavity extended down to the triangular ligament. In the female this becomes the pouch of Douglas. In the male the pouch is obliterated. When the peritoneal layers fuse, the mesothelium is absorbed and disappears leaving only a bed of mesenchyme; hence Denonvilliers' fascia or the fascia between the prostate and the rectum consists of two layers, one covering the prostate and the other the adjacent rectum. The anterior layer, adherent to the prostate, is the thicker and in it the elastic tissue fibrils predominate thereby causing the characteristic shiny appearance of Denonvilliers' fascia.

The operative space in the perineum is limited, hence special instruments are required which must not be bulky. The blade of an improperly shaped posterior retractor can easily cut into the rectum. If the surgeon uses blunt

instead of sharp dissection to remove the posterior layer of Denonvilliers' fascia, he will usually enter the rectum.

The urethral tractor must be inserted close to the apex of the prostate; but if it is too far forward, the external sphincter will be damaged. The prostate is pulled upward and the capsule then cut with two oblique incisions that make an acute angle near the apex. If the incision extends too far laterally, nerves are injured with resultant incontinence. The tip of the inverted V must then be pulled downward with an Allis forceps and a transverse cut made distal to the verumontanum through the capsule of the tumor so that the ejaculatory ducts lie outside the field of the removal of the hypertrophy. Also, great care must be used in bluntly separating the hypertrophy from the neck of the bladder; otherwise the internal sphincter will be damaged or even destroyed. If the hypertrophy is wholly extravesical, the internal sphincter should not be molested and remains watertight throughout the operation. The advantages of this approach are as follows: (1) The operation is performed under vision. (2) Bleeding can be easily controlled. (3) Drainage is pendulous. (4) The patient quickly becomes ambulatory. (5) If malignancy is suspected, a frozen section can be made at once and total prostatectomy performed when indicated.

*Transvesical Suprapubic Prostatectomy.* This is the operation of choice in cases in which the tumor is very large and prostatic intrusion is mainly intravesical, stricture of urethra prevents instrumentation, ankylosis of hips precludes other surgical positions or there are vesical complications such as stones, neoplasms and diverticula.

The first complete suprapubic prostatectomy was performed by Eugene Fuller of New York City in 1894 and a modification of his method with a series of cases was reported in August, 1900, by Ramon Guiteras, the founder of the American Urological Association, before the International Congress in Paris at which meeting Mr. Peter J. Freyer of London was present. In the *British Medical Journal* of July 20, 1901, Mr. Freyer reported four cases and by the uninformed he has been given credit for having originated the operation.

The success of this operation also depends upon a knowledge of anatomy and an appreciation of its possible variations. Theoretically, when the bladder is distended, its anterior wall lies uncovered below the peritoneum. However, the peritoneum frequently extends over it as a fold down to the symphysis pubis. It is for this reason that aspiration by trocars occasionally results in untoward complications. When the surgeon finds the bladder covered by the peritoneum, he has to pull it up by blunt dissection. Such maneuvers usually open the prevesical space (space of Retzius); a puddle of infected urine in the pocket is frequently the cause of troublesome infection. To prevent this some surgeons, as their first step, wall off the prevesical space with mattress sutures. The bladder should be opened as near its dome as possible.

There are two methods of approaching the tumor, from above or below: First, with a finger in the vesical orifice break through the anterior commissure (if too much force is used and the prostatic capsule is torn dorsally, the plexus of Santorini will cause a troublesome hemorrhage) and follow the line of cleavage about the capsule of the tumor mass. Second, posteriorly cut the mucous membrane over the median lobe and with a finger or dissecting instrument follow the line of cleavage forward about the tumor mass. There is always trouble in getting the apical part free.

The tumor should be removed leaving the verumontanum unmolested. The short-fingered operator cannot reach this far, so he will have to push the prostate up with one or two fingers in the rectum. If undue force is used in pulling on the "lobes," the verumontanum may be torn out along with part of the external sphincter. Occasionally there are spheroids in the compressed prostatic tissue of the posterior lamella and these can be picked out with an artery clamp.

The drainage tube should be placed in the upper part of the bladder incision so as to keep it away from the space of Retzius. Then the tube should be pulled downward so that when the muscles and fascia are closed it is in the lower end of the incision. Otherwise, urine that leaks out will flow over the skin suture line and tend to break down the incision.

When a two-stage operation is performed, the enucleation is carried out wholly by touch because the incision is enlarged only sufficiently to permit the entrance of an index finger.

*Retropubic Prostatectomy.* This extravesical operation is comparable to a perineal prostatec-

tomy in reverse, that is, performed from above, but it misses the benefit of pendulous drainage.

The procedure was published in 1933 by Jacobs and Casper of San Francisco. They saw a surgeon use too much force in breaking through the anterior commissure while doing a suprapubic prostatectomy and his finger came up in the space of Retzius. After five operations (two cancers) they discarded the procedure. It was rediscovered in 1945 by Terence Millin of London. Theoretically, it is an ideal method because the bladder is not opened, the verumontanum and ejaculatory ducts are not disturbed, all bleeding is stopped under vision and the prostatic capsule is tightly closed. However, osteitis pubis is a frequent complication and sufficient time has not elapsed to evaluate the operation properly.

*Prostatic Resection.* Transurethral resection is the most popular of all procedures because it can be performed by the medical urologist who is not trained in surgical technic. Dr. Hugh H. Young devised a punch in 1908 comparable to a kitchen apple corer for the treatment of a prostatic median bar or contracture of the vesical orifice. It has now been electrified, wired for light and cutting, and modified into the resectoscope. The number of operators is in direct ratio to the persuasiveness of the salesman, who also sells incontinence clamps. Dr. Young, who was professor at Johns Hopkins Medical School and the father of modern American urology, published at the end of thirty years a résumé of his 997 prostatectomies of all types. Many overenthusiastic neophytes, after a few years of medical practice, have a larger series of resections including all ages and sexes. (Last year over 5,000 incontinence clamps were sold.)

All agree that this operation has an important place in the field of surgical urology. It is indicated for contractures, median bars, small growths and strictures due to cancer. Hemorrhage is usually easily controlled by means of the bag catheter, a description of which was published in 1933 by Colonel Hobart D. Belknap of Portland, Oregon. (It was not patented and is now sold under various names.) The hospital stay is short and there is no skin incision to heal. However, if the time of operation is long, there is danger of overloading the system with fluids flowing in through the operative field. This operation is a highly technical procedure for the removal of large growths and the instrument is exceedingly dangerous in the hands of one who is not thoroughly familiar with the anatomy of the region involved. It is very easy to cut into the rectum or through the bladder wall. The use of heavy spark gap machines to control bleeding is likely to cause sloughs followed with sepsis, as well as destruction of the cystoscopic telescope by "arcing." (The instrument makers have refused to guarantee instruments so destroyed.)

The advocates of this method insist that they remove all prostatic tissue down to the "capsule" but they neglect to specify which capsule. The true surgical prostatectomist removes only the tumor mass with its capsule, leaving the compressed gland and capsule of the prostate. When the vesical orifice is completely coned, the internal sphincter is destroyed; and in the cases in which potency persists the patient ejaculates into his bladder. Then when a malpractice suit is filed, the matter ceases to be medical and becomes legal, and jurors are very sympathetic to such complaints. The most annoying complication is prolonged pyuria due to sloughs from fulgurated tissue and lack of open drainage.

No man has the right to be classified as a urologic surgeon unless he is competent to perform a prostatectomy by any of the four recognized methods. There are two fundamental requirements, namely, a sound grounding in anatomy and a thorough training in surgical technic. Since the introduction of suction pumps and antibiotics, all four methods are good and each has its definite indications.

REFERENCE

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# FURTHER STUDIES OF THE RATE OF HEALING OF HUMAN SKIN MEASURED BY THE ELECTRICAL WOUND POTENTIAL OF EXPERIMENTAL ABRASIONS*

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At the present time there is no entirely satisfactory method of measuring the rate of wound healing in experimental animals or man. Each method should be explored by quantitative procedures which will give reliable data for comparison with other methods. A previous paper[6] and several abstracts[2–17] described the decline in magnitude of the electrical potential of human skin abrasions which occurs as healing proceeds. A brief history of the investigation of wound potentials in skin was included in a previous publication.[6] The electrical method of following the healing process of a wound yields a more scientific record than does the usual visual inspection of the lesion. The visual method was elaborated by Du Nouy in the form of a mathematical equation containing factors for area of wound and time of healing.[29] However, the area is determined by the eye and not machine recording as in the electrical method. In 1950 Crane measured the electrical potential of a human wound severe enough to require sutures. As in our studies of minor skin abrasions, he found that the wound potential decreased with healing.

The present report includes an electrical investigation of an experimental abrasion of a somewhat larger area than the small abrasions on the fingertips described in previous publications. The difference in healing rates on the four fingers of the hand is also presented. This electrical polarity of the hand must be considered when comparing various dressings on the different fingers. Finally, the healing rates of minor abrasions of fingers treated with various experimental dressings are described.

## METHODS

A Leeds and Northrup Micromax recording potentiometer was used as in previous investigations.[6] The scale was 0 to 100 millivolts accurate to 0.3 millivolt. Paper speed was ½ inch in fifteen minutes (note the fifteen-minute time marks on the abscissa of Figures 1 and 2 are approximate since the recorder was turned off for approximately one-half minute during movement of the salt bridge across the wound). For the finger-to-finger potential measurements a reversing key to change polarity was inserted in the circuit for two reasons: (1) Control potentials between fingertips before excoriation may be positive or negative on right or left (by a few millivolts). (2) Although skin wounds are always positive with respect to the other electrode on the intact skin, recently healed skin is sometimes negatively charged in respect to older intact skin. This swing in potential of a recently healed wound from positive to negative is called overshoot potential. In cases of experimental finger abrasions the percentage loss in wound potential was divided by the number of hours giving the percentage healing per hour or healing index. Two fingers were dressed with the drug tested and two fingers had the vehicle alone. The healing indices of the two treated fingers were averaged together and also the indices of the two controls. Thus the rate of healing of the treated abrasions can be compared with the rate of healing of the control abrasions on the same person at the same time.

To minimize fluctuations in potential (1) avoid movement of electrodes, saline cups or fingers, (2) avoid pressure on skin which produces positivity, (3) avoid talking to or startling subject which may produce a psychogalvanic potential of a few millivolts and (4) rechlorinate silver electrodes daily or at any time unexplained potentials occur. We did not encounter the wide spontaneous changes reported by Fardon, Judd, and Prince.[25]

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To measure the potential of the larger abrasion on the arm the tip of the little finger of the opposite (right) arm was dipped into a saline cup connected by a small salt bridge to the reference electrode. A long salt bridge (i.e., 35 cm.) reached from the other electrode cup to the wounded area. This bridge was a glass tube 6 mm. in diameter bent into a slight arc and filled with 0.9 per cent NaCl in agar. These bridges can be made in any convenient length or curvature to reach a wound on any part of the body. To avoid contamination of the wound the tip of the glass bridge can be broken off and cotton soaked in sterile saline tied over the end (also cresol can be added to the agar). For rapid work a new bridge can be used for each determination. The tip of the long bridge is moved across the arm from the intact skin on one side, across the wounded surface to the opposite boundary and over the intact skin on the opposite side. The recording potentiometer is stopped at each change of position of the salt bridge (a shift in position of 1 mm. to 1 cm. is usual). The resulting record appears in the form of plateaux or "steps," each level indicating the potential at a particular spot on the wound or adjacent skin.

## RESULTS

The larger abrasion 3 cm. in diameter made with sterilized sandpaper on the forearm gave the usual positive wound potential which was 59 millivolts (peak potential) immediately after excoriation and rose to 70 millivolts the second day. This preliminary rise in wound potential is also sometimes seen in the smaller fingertip abrasions and was found by Crane (1950) in a wound that requires sutures. However, in our experiment the reference electrode was on the little finger of the opposite arm so we have an unknown variable consisting of the potential difference between the wound and the reference electrode. In spite of this possible error in baseline potential the records presented in Figures 1 and 2 and plotted in Figure 3 clearly show the decline in total potential as the wound healed. On the tenth day the potential has decreased to 20 mv.

As will be seen in Figures 1 and 2 and Table 1, there is considerable variation from point to point across the arm near and over the lesion. There appears to be some spread of potential from the wound to the intact skin near the boundary. It is clear, however, that the peak potential declines as the healing proceeds. The data show that the electrical method of measuring wound healing can be applied to a wound of wider area than small abrasions on the fingertips previously investigated.

For investigating the effects of various dressings on wounds the original method of produc-

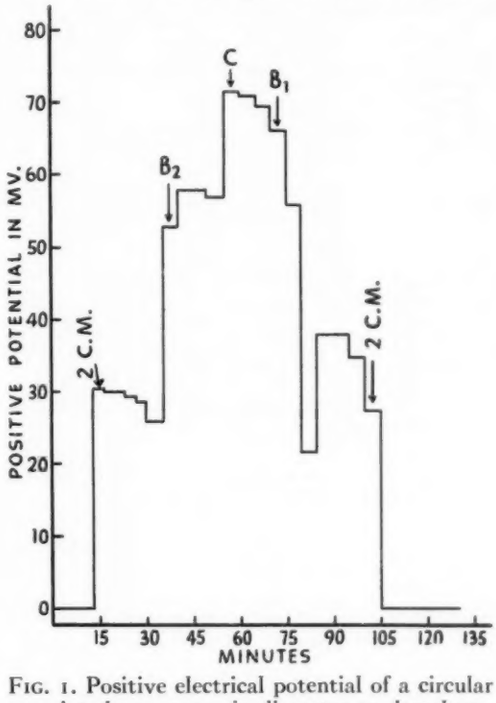


FIG. 1. Positive electrical potential of a circular excoriated area 3 cm. in diameter on dorsal surface of forearm (the area was rubbed with sterile sandpaper). This graph was recorded by a Micromax potentiometer twenty-four hours after the skin was abraded. A long salt bridge made contact with the wound. Ordinates: Millivolts positive potential (with respect to uninjured fingertip). Abscissas: Time marked in fifteen-minute intervals (the recorder was stopped frequently when the salt bridge was moved to a new location on the surface of the arm). Each level indicates the recording of the potential at successive locations as the tip of the salt bridge was moved across the arm from a point on the intact skin 2 cm. from boundary of the wound to the corresponding location on the opposite side. The salt bridge was stationary during recording. Read from right to left. The level marked 2 cm. was situated 2 cm. from the boundary of the wounded area (on the adjacent intact skin). $B_1$ and $B_2$ are positive levels at each boundary of the wound on the straight line along which the electrode was moved. C is the center of the wound. The zero potential line is slightly above the baseline which indicates a zero error in the AgAgCl electrodes when they were connected together through the salt bridges (arm not in circuit). See Table 1 for potentials of this wound on third day and see Figure 2 for potentials of this wound on seventh day.

ing small abrasions was employed because of rapidity of healing and the opportunity of running controls on fingers of the same hand at the same time.

Differences in the healing rates of different fingers such as the index and little fingers were apparent from casual inspection of the Micromax recordings. A systematic investigation was made of this polarity of the hand. The results are presented in Table II. It will be seen that the index finger tends to heal faster than the little finger. All fingers in this series were dressed with chloresium ointment (0.5 per cent chlorophyll) to shorten the time of experiments.

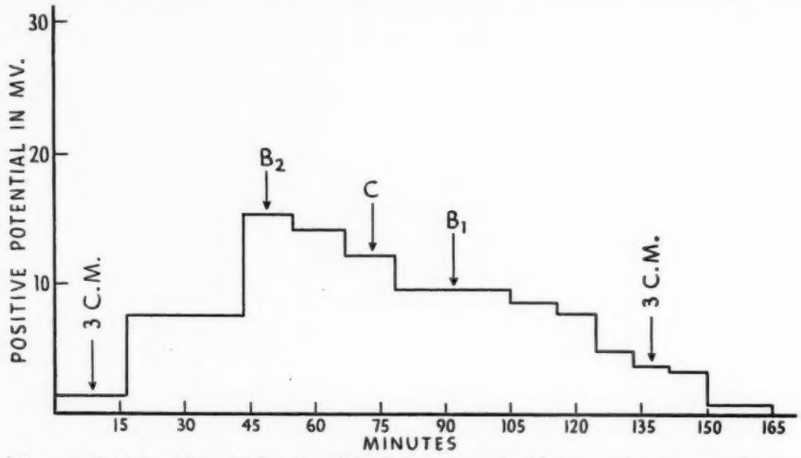


FIG. 2. Positive electrical potential of the same circular excoriated area shown in Figure 1. The above measurements were taken one week after the wound was made. See Table 1 for the potentials of this lesion on the third day. Note that the healing is shown by the decrease in total wound potentials. The diameter of the wound was at 2 cm. (reduced from 3 cm. at the start). See Figure 1 for explanation of method of recording potential levels and for explanation of labelling.

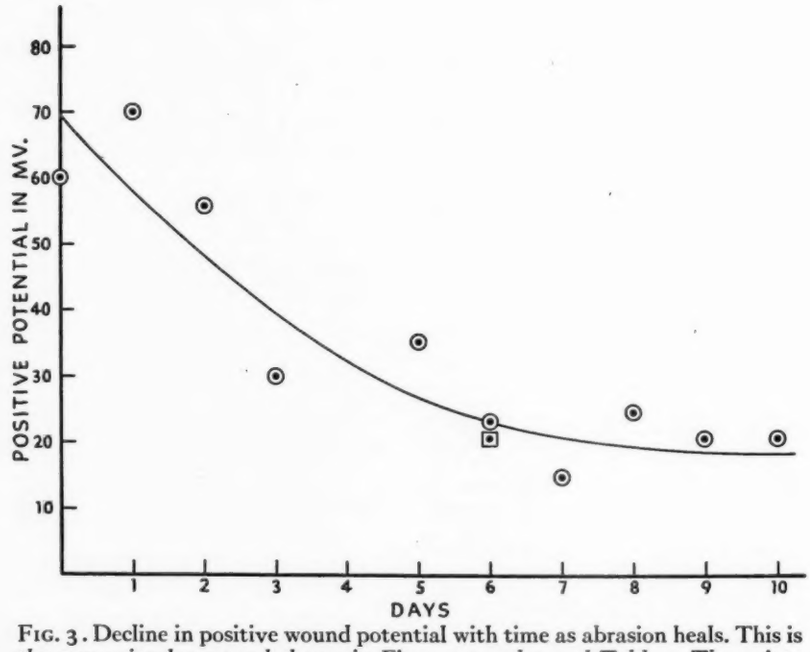


FIG. 3. Decline in positive wound potential with time as abrasion heals. This is the same circular wound shown in Figures 1 and 2 and Table 1. The points plotted above are peak potentials. On the sixth day the reading represented by a square (instead of a circle) was taken while the circulation of the arm was arrested by inflation of a sphygmomanometer cuff. The wound potential is not directly affected by the circulation.

When comparing two types of dressings the dressings must be rotated from finger to finger in a series of experiments.

Dressings containing chlorophyll were found to give a higher healing index (per cent wound potential lost per hour) than dressings containing the ointment vehicle alone when run on the same person at the same time (care was taken to alternate the fingers in successive runs). (Table III.) The healing rate of the controls for chlorophyll were unusually slow. The healing effect of chlorophyll is known to be more pronounced on slowly healing lesions. Sulfanilamide and hydrosulphosol gave lower healing indices than controls while scarlet red appeared to be without effect on the healing rate. (Tables IV to VIII.) A new quantitative expression of the action of a drug on the healing rate is called the healing differential and is presented in Table VIII. This healing differential is defined as the difference between the per cent wound potential lost per hour in minor abrasions treated with the alleged healing agent and the per cent wound potential lost per hour in control abrasions on the same hand at the same time treated with the vehicle or ointment without the alleged healing agent.

For comparison of the healing rate of the large circular abrasion and the healing rate of the smaller abrasions on the fingertips we have plotted the rates for the petrolatum controls taken from several experiments on the same person. (Fig. 4.)

## COMMENTS

The decline in wound potential with healing follows a course similar to the increase in strength of a sutured wound as described by Howes[26] and to the decrease in wound area described by many authors, in particular Apperly and Cary,[1] and Moss, Morrow, Long and Ravdin.[29] Taylor and Ziperman[33] have recently commented on the limitations of the usual (non-electrical) methods of measuring wound healing. Sandblom[30] has reviewed the method of measuring the tensile strength of wounds in animals as an indicator of healing. It is now

TABLE I

MEASUREMENTS OF WOUND POTENTIAL*

| Location (Point Where Potential Was Measured) | Potential of Surface of Arm Positive to Reference Electrode on Fingertip (mv.) |
|---|---|
| Intact skin 3.3 cm. from boundary of wound | 12 |
| Intact skin 2.9 cm. from boundary of wound | 13 |
| Intact skin 2.0 cm. from boundary of wound | 14 |
| Intact skin 1.2 cm. from boundary of wound | 28 |
| Intact skin 0.4 cm. from boundary of wound | 35 |
| Intact skin 0.1 cm. from boundary of wound | 23 |
| Boundary of wound | 48 |
| Within excoriated area 0.4 cm. from boundary | 53 |
| Within excoriated area 1.0 cm. from boundary | 56 |
| Center of excoriated area 1.5 cm. from circumference | 51 |
| Within excoriated area 1 cm. from opposite boundary | 54 |
| Within excoriated area 0.3 cm. from opposite boundary | 55 |
| Boundary of wound | 54 |
| Intact skin 0.1 cm. from opposite boundary | 38 |
| Intact skin 0.5 cm. from opposite boundary | 44 |
| Intact skin 0.8 cm. from opposite boundary | 44 |
| Intact skin 1.2 cm. from opposite boundary | 42 |
| Intact skin 2.2 cm. from opposite boundary | 22 |
| Intact skin 3.0 cm. from opposite boundary | 16 |
| Intact skin 4.0 cm. from opposite boundary | 13 |

Note: Electrodes short-circuited through salt bridges gave 3.5 mv. positive and this correction was made on all readings above.

*Levels of positive potential (with respect to fingertip on opposite arm) on surface of forearm near and on abraded area. These recordings were made on the third day (see Figure 1 for potential map on second day and Figure 2 for decreased potential on seventh day). The salt bridge (glass tube 6 mm. in diameter filled with saline agar) made contact with a linear series of locations passing from the intact skin 3.3 cm. from the boundary of the wound, thence across the wound in successive measurements to a point on the intact skin 4 cm. away from the opposite boundary of the wounded area. As recorded by the Micromax potentiometer the graph appears as a series of steps as seen in Figures 1 and 2.

TABLE II

RELATIONSHIPS BETWEEN MAGNITUDE OF WOUND POTENTIALS, POSITION OF FINGER ON HAND AND RATE OF HEALING*

| Finger | Average Potential below 30 mv. | No. of Cases | Average Healing Rate | Average Potential 30 mv. and more | No. of Cases | Average Healing Rate |
|---|---|---|---|---|---|---|
| Index | 21.9 | 16 | 2.45 ± 0.26% | 33.8 | 7 | 2.42 ± 0.22% |
| Middle | 23.2 | 14 | 2.10 ± 0.21% | 37.0 | 9 | 2.80 ± 0.25% |
| Third | 20.8 | 11 | 1.67 ± 0.40% | 36.0 | 12 | 2.35 ± 0.11% |
| Little | 22.3 | 9 | 1.63 ± 0.50% | 40.5 | 14 | 1.45 ± 0.31% |

*This study is limited to minor abrasions on fingertips of similar magnitude.

evident that the magnitude of the electrical wound potential is a quantitative measure of the degree of healing. We have previously[6] shown the value of the electrical method with small abrasions on the fingertips and the study demonstrates that the healing of a larger surface may be followed by this method. To complete the picture Crane[22] has applied our electrical method successfully to a deeper sutured wound. As pointed out by Burr,[20] fur-

TABLE III

HEALING RATES OF EXPERIMENTAL ABRASIONS ON THE FINGERS TREATED WITH CHLOROPHYLL*

| Subject | Experiment No. | Concentration of Chlorophyll (%) | Vehicle | Healing Rate Chlorophyll (%) | Healing Rate Control (%) | Hours |
|---|---|---|---|---|---|---|
| Ba | C1 | 1 | Petrolatum | 3.09 | -0.50 | 18 |
| Ba | C2 | 1 | Petrolatum | 5.60 | 1.98 | 22 |
| Ba | C3 | 1 | Petrolatum | 0.61 | 0.50 | 123 |
| Po | C4 | 1 | Petrolatum | 1.27 | 0.82 | 70 |
| Ba | C5 | 1 | Resin | 5.10 | 3.12 | 17 |
| To | C6 | 1 | Resin | 1.06 | -0.17 | 23 |
| Pu | C7 | 1 | Resin | 1.43 | -0.38 | 23 |
| We | C8 | 1 | Resin | 1.14 | 1.60 | 50 |
| Ba | C9 | 0.2 | Saline | 3.40 | 1.83 | 24 |
| Ba | C10 | 0.2 | Saline | 1.60 | 1.49 | 48 |

*Healing rates are the per cent loss of wound potential per hr.

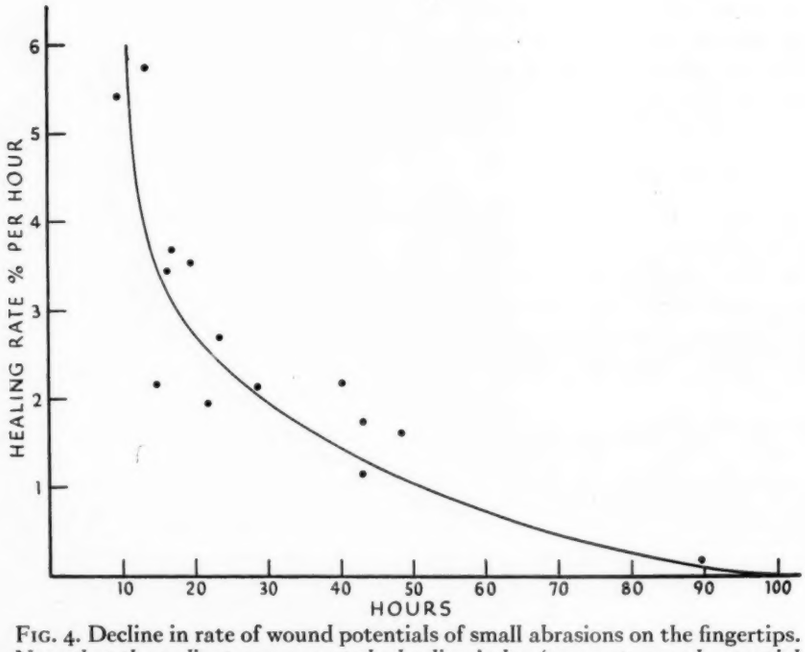


FIG. 4. Decline in rate of wound potentials of small abrasions on the fingertips. Note that the ordinates represent the healing index (per cent wound potential lost per hour or rate of healing) and not the magnitude of the potential as in Figure 3. All measurements taken from same individual during several experiments. Each point is the average healing index for two fingers run at the same time. Petrolatum dressings only. Abscissas: Time in ten-hour intervals.

ther studies of the relations between pathology and the standing potential are urgently needed.

As will be seen in Figures 1 and 2, there are interesting variations in the wound potential in various zones of the abraded region and adjacent skin which we shall investigate more thoroughly in the near future. At the present time we merely wish to emphasize the fall in peak and in total potential which occurs in healing. Another problem for future research is the electrical effect of infection. With finger abrasions we can always spot infection by the persistence of the wound potential. Also, other regions of the body remain to be explored electrically. For example, we found the usual positive wound potential in the gums after extraction of a tooth. This potential declines with healing.

The finding of higher healing index for chlorophyll dressings than for controls confirms the work of Smith and Livingston[32] who used the visual method on guinea pigs and dogs. Lam and Brock (1950) reported a slight advantage for chlorophyll on experimental wounds in guinea pigs but no electrical potentials were recorded. Interest in the possible healing effect of chlorophyll has persisted since the original report of Bürgi.[19] Retardation of healing by topical sulfanilamide is well known clinically (Bick[18]) although dusting with sulfanilamide powder is sometimes recommended (Lowry,[28] Cannaday[21]). The electrical method yielded a low healing index for hydrosulphosol, an ointment containing polysulfides and thiosulfates.

TABLE IV

HEALING RATES WITH SULFANILAMIDE POWDER*

| Experiment No. | Healing Rate Sulfanilamide (%) | Healing Rate Control (%) | Hours |
|---|---|---|---|
| S1 | 1.06 | 1.71 | 45 |
| S2 | 2.78 | 3.66 | 22 |
| S3 | 1.98 | 3.84 | 26 |
| S4 | 1.28 | 1.70 | 18 |

*Control fingers had dry bandage. All tests on same person.

TABLE V

HEALING RATES WITH HYDROSULPHOSOL*

| Experiment No. | Healing Rate Hydrosulphosol (%) | Healing Rate Controls Ointment Vehicle (%) | Hours |
|---|---|---|---|
| H1 | 2.0 | 2.1 | 48 |
| H2 | 2.62 | 1.98 | 26 |
| H3 | 1.83 | 3.67 | 19.5 |
| H4 | 3.8 | 3.7 | 17 |
| H5 | 0.63 | 2.41 | 23.5 |

*All tests on same person.

TABLE VI

HEALING RATE WITH 1 PER CENT SCARLET RED*

| Experiment No. | Healing Rate Scarlet Red (%) | Healing Rate Controls (%) | Hours |
|---|---|---|---|
| SR1 | 3.08 | 3.57 | 21 |
| SR2 | 3.63 | 5.00 | 19 |
| SR3 | 2.43 | 0.48 | 18 |

*All abrasions on same person. Vehicle was petrolatum.

TABLE VII

HEALING RATES WITH VARIOUS DRESSINGS

| | | | |
|---|---|---|---|
| Chlorophyll | $2.43 \pm 0.37$ | Controls | $1.13 \pm 0.27$ |
| Scarlet red | $3.01 \pm 2.27$ | Controls | $3.04 \pm 1.01$ |
| Hydrosulphosol | $2.17 \pm 0.35$ | Controls | $2.73 \pm 0.30$ |
| Sulfanilamide | $1.77 \pm 0.28$ | Controls | $2.72 \pm 0.35$ |

TABLE VIII

HEALING DIFFERENTIAL WITH VARIOUS DRESSINGS

| | |
|---|---|
| Chlorophyll | +1.30 |
| Scarlet red | -0.03 |
| Hydrosulphosol | -0.56 |
| Sulfanilamide | -0.92 |

Cruthirds[23] reported less scarring with this dressing on x-ray burns. The problem of scarring has not been investigated by the electrical method (but according to our theory thick scar tissue should be electronegative).

A discussion of the mechanism of origin of wound potential is beyond the scope of this paper (Schaefer).[31] There are, of course, many other factors besides electrical potential which can be measured in experimental wounds. For example, Danielli, Fell and Kodicek[24] have studied the effect of vitamin C deficiency on

the phosphatase activity in experimental wounds in the guinea pig.


## SUMMARY

1. An experimental wound consisting of a circular abrasion 3 cm. in diameter on the arm showed a decline in positive electrical wound potential as healing progressed. This electrical sign of growth was slower in rate but similar to the decrease of potential previously described for smaller abrasions on the fingertips.

2. Abrasions of the index finger heal more rapidly than those on the little finger. This electrical polarity of the human hand must be recognized when testing the effects of drugs on finger potentials.

3. The rate of decline of wound potential is described for various dressings on experimental abrasions.


*Acknowledgment:* We wish to express our thanks to Dr. Joseph R. Di Palma for helpful advice.

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Modern Operative Technics

No. 6

# SPLENORENAL SHUNT FOR PORTAL HYPERTENSION*

## THORACICO-ABDOMINAL APPROACH

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A RATIONAL and effective method of treatment of portal hypertension became available when Blakemore and Lord[1] showed that functioning shunts could be made between the system with the high pressure and the vena cava with its low pressure. The distressing condition of ascites and the dangerous bleeding from esophageal varices which may accompany hepatic cirrhosis are usually relieved when a satisfactory anastomosis is established. Two kinds of shunts were suggested, namely, the end-to-end splenorenal with sacrifice of the left kidney and the end-to-side portacaval shunt. Blakemore and Lord originally used a non-suture method of anastomosis in which they employed tubular prostheses of vitallium.® They chose this method rather than the admittedly ideal suture method because of fear that the execution of the latter might be "compromised by unfavorable circumstances, such, for example as inadequate exposure." Indeed, inadequate or at least difficult exposure was the rule rather than the exception when the operation was attempted through conventional abdominal incisions. Many surgeons have unashamedly confessed to taking five or six hours for the operation and the blood loss during these long procedures has been great. It has been suggested that blood replacement in some of these cases may result in sodium citrate intoxication with incoagulability of the circulating blood and fatal hemorrhage from capillary bleeding.[2] I believe this caused the death of one of my patients.

Fortunately about the time that shunts for portal hypertension began to be done, surgeons began to utilize the left thoracico-abdominal approach for operations involving the cardia of the stomach and the spleen. The advantages were clearly described by Humphreys[3] and later by Garlock,[4] Harper[5] and Carter.[6] It was inevitable that the incision would be a great boon to the surgeon doing the difficult shunt operations. Blakemore[7] adopted it early and stated in 1949 that in seventy cases of splenorenal shunt the majority had been done by that approach. Linton[2] also found it useful. The right-sided counterpart of the incision was found to be equally valuable in the procedure of direct portacaval anastomosis; this was emphasized by Satinsky,[8] Heaney and Humphreys[9] and Carter and Helmsworth.[10]

The operation described herein is that of splenectomy and splenorenal anastomosis with preservation of the left kidney through a thoracico-abdominal approach. It is not in the province of this paper to discuss the indications for any shunt operation or the indications for the left or right operation. Suffice it to say that there are many cases of portal hypertension in which it appears to be desirable to remove the large spleen which automatically cuts down on the portal flow considerably, and at the same time to carry out a shunting procedure with the stump of the splenic vein. It is admitted that the shunt will be smaller than the side-to-side portacaval and consequently there is more danger of thrombosis. Even so there is some degree of comfort in the realization that an operation on the right side is still possible if the desired result is not obtained on the left. The desirability of non-sacrifice of the left kidney is obvious and this is accomplished by making an end-to-side rather than an end-to-end anastomosis of the splenic to the renal

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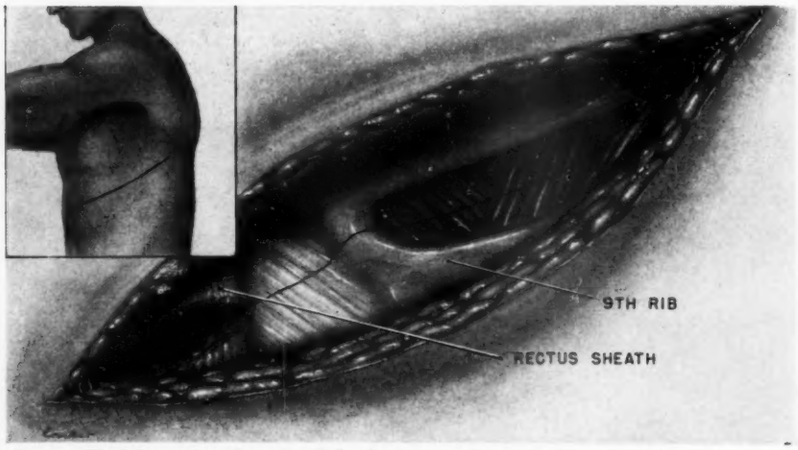



FIG. 1. Position of patient for left thoracico-abdominal approach and incision over the eighth intercostal space.

vein. There is some experimental evidence to show that the latter method is associated with less thrombosis.[11]

## TECHNIC

Anesthesia by the endotracheal method is established and a cannula is placed in a saphenous vein for the administration of intravenous fluids. The patient is placed on his right side with the arms comfortably forward out of the way. (Fig. 1.) The incision extends from the midline anteriorly to the posterior axillary line over the eighth intercostal space. It is deepened through the left rectus muscle and any slips of the serratus anterior which overly the interspace. The pleural and peritoneal cavities are then entered by cutting through the cartilaginous costal arch, the intercostal muscles and pleura, and the posterior sheath and peritoneum.

The diaphragm is incised from the point of division of the cartilage to a point far enough posterior to provide complete visualization of the spleen. The excellent exposure for removal of the spleen is at once obvious. (Fig. 2.) At this time the other abdominal organs are inspected or palpated and a biopsy can be taken from the liver. The veins in the region of the spleen and stomach are apt to be remarkably enlarged and the blood is under high pressure so that troublesome bleeding results if the veins are torn by rough handling. A needle may be inserted into a small tributary of the splenic vein to measure the portal pressure by means of a water manometer. Pressures of 350 to 500 mm. of water may be encountered as compared with a normal of 100 mm.

In proceding with the splenectomy any adhesions encountered are divided between clamps which are carefully replaced by ligatures. The spleen may then be dislocated out of its bed and rotated in any desired direction during the division of the short gastric vessels and the structures in the pedicle. (Fig. 3.) Theoretically it is advisable to prevent additional congestion of the spleen during its removal by ligating the splenic artery before the main vein. A bulldog clamp is placed on the splenic vein and it is divided at the point where it receives its first large branches and irrigated with saline solution. Every millimeter of length which is available for the subsequent anastomosis should be preserved.

The renal vein is then exposed. (Fig. 4.) The peritoneum is opened over the hilum of the kidney and the vascular structures are carefully separated. It is not necessary to disturb the kidney itself. The stump of the splenic vein is then brought down to the renal to see if the length is sufficient. If it is not, it will be necessary to mobilize further vein from above and behind the pancreas. In this situation the tiny radicals of the vein must be divided between ligatures with the greatest care. The renal vein is then occluded appropriately so that an opening may be made in its side to receive the end of the splenic vein. It may be completely occluded on both sides of the proposed opening; but if this is done, the artery must also be temporarily occluded to prevent congestion. I have found it convenient to use the Potts clamp which was designed for the aortic-pulmonary anastomosis in cyanotic children;

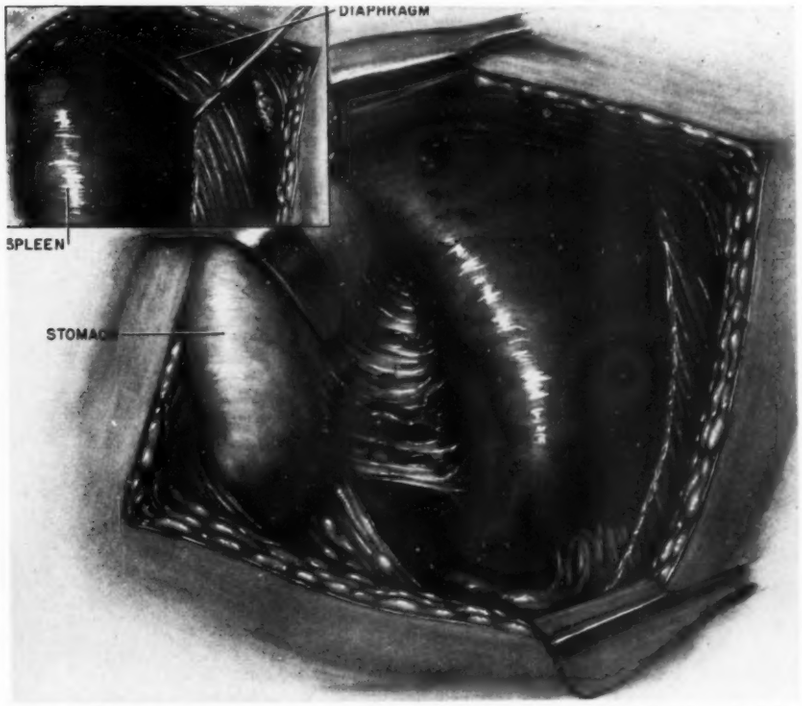
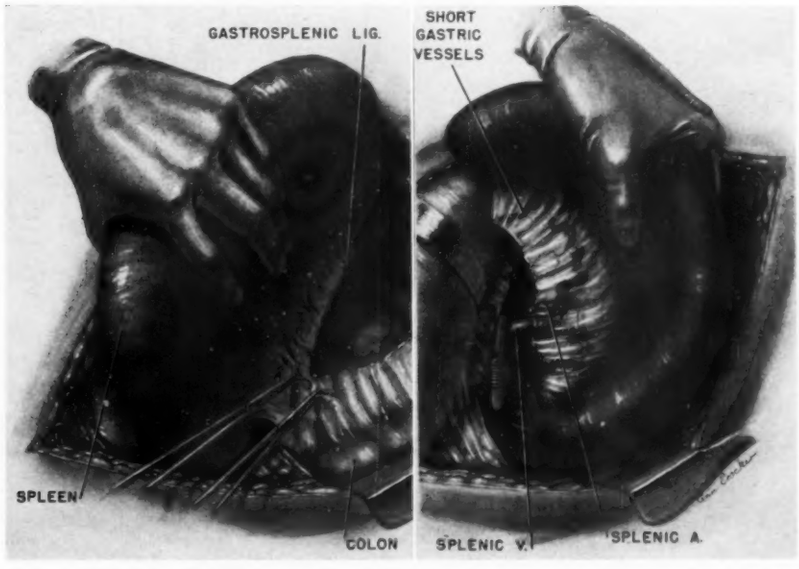



FIG. 2. Shows excellent exposure of the spleen and stomach following division of the costal arch, diaphragm and peritoneum.




3A 3B

FIG. 3. A, The spleen is moved from side to side as necessary to divide the vascular structures under direct vision; B, the next step is division of the splenic vein near the hilum.

this permits sufficient venous outflow so that the artery need not be clamped.

The anastomosis is made exactly according to Blalock's[12] directions for an end-to-side subclavian-pulmonary anastomosis. Using an atraumatic vascular needle with a No. 5-0 deknatel suture attached, a posterior row of everting horizontal mattress sutures is placed. This suture line is tightened and the ends are tied to medial and lateral stay sutures. The horizontal mattress suture is continued around anteriorly and may be interrupted once again

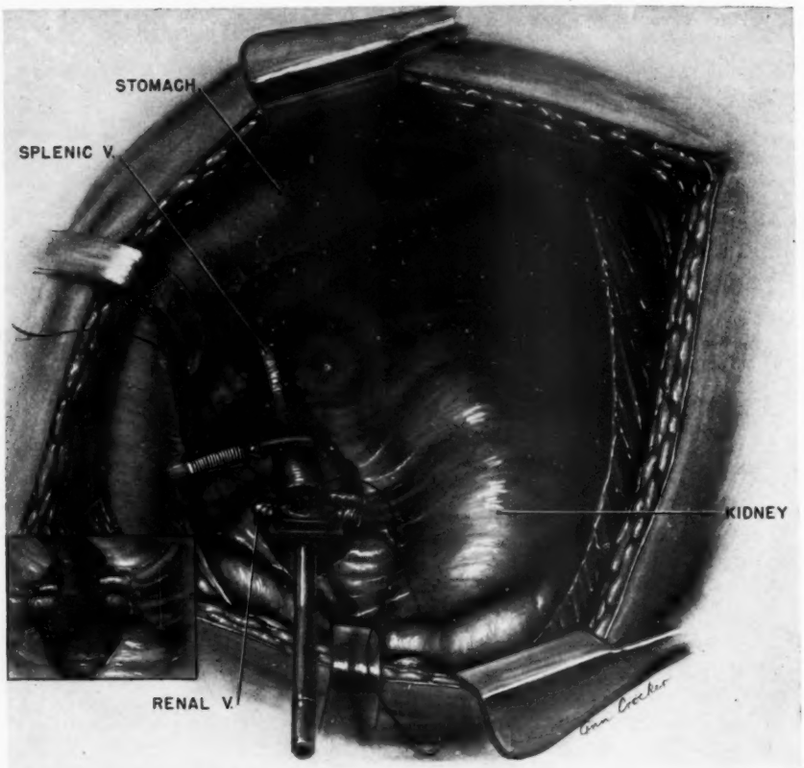



FIG. 4. Placement of the posterior suture line for the end-to-side anastomosis of splenic vein to renal vein. Inset: Anastomosis completed.

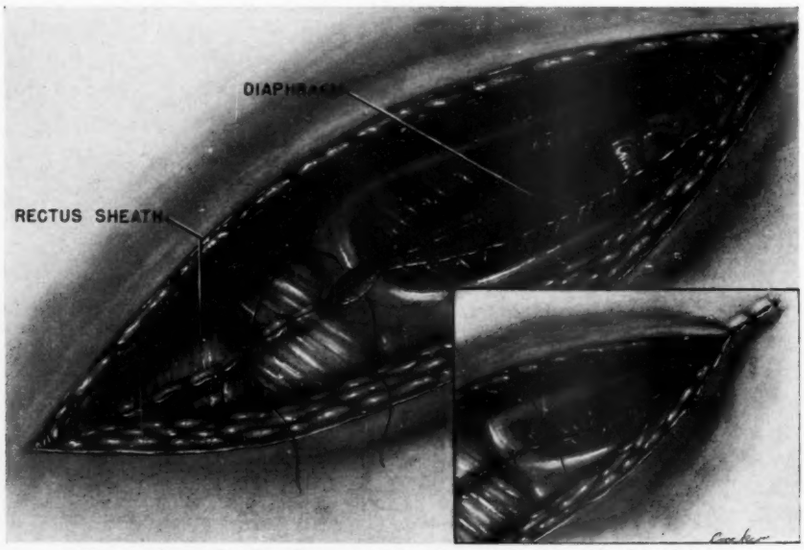



FIG. 5. Steps in the closure of the thoracico-abdominal incision.

by a stay suture. Care is taken to prevent a purse-string effect of the suture which would diminish the size of the anastomosis. After the completion of the suture line the Potts clamp is removed followed with the bulldog clamp on the splenic vein. It will be noticed that the flow of blood is in the direction of the renal vein and the vena cava and that the pressure in the splenic vein is markedly reduced. The residual pressure may be measured with the water manometer but it is advisable to use a very small needle for puncturing the thin-walled

vein. If there is any tendency to kinking due to redundancy of the splenic pedicle, it should be corrected by appropriate suturing to the posterior abdominal wall.

The incision in the diaphragm is closed with silk sutures and the ends of the cut cartilage are accurately approximated. (Fig. 5.) The anesthetist expands the lung with gentle positive pressure. Then 100,000 units of penicillin are divided between the peritoneal and pleural cavities. A catheter is placed in the pleural cavity for the evacuation of air after the skin is closed. The ribs are held together with three pericostal sutures, the abdominal portion of the incision is closed in two layers and any muscle structures on the chest which were cut are sutured. The skin is closed with interrupted sutures.

The utility of this operation is illustrated in the following case report in which splenectomy and splenorenal shunt were carried out in a patient whose blood was incompatible with any available prospective donors.

## CASE REPORT

S. De M. was a woman twenty-two years of age when first seen in 1947, who complained of a lump in the left side which proved to be the spleen. The provisional diagnosis of myelogenous leukemia was made. In June, 1949, the abdomen was explored and biopsies were taken of the liver and spleen. These showed cirrhosis of the liver and congestive splenomegaly. It was noted that the veins of the omentum were large and tortuous. The patient was given medical treatment for the cirrhosis. On February 26, 1950, she had tarry stools and later vomited about 1 quart of blood; it was obvious that she was bleeding from esophageal varices. She was given a number of transfusions and by March 1st the hemoglobin was 12.9 gm. A splenorenal shunt was advised. While this advice was being considered, she developed menorrhagia and became anemic again. On March 14th an attempt was made to give a blood transfusion; but after 100 cc. had been administered, the patient had a chill and her temperature rose to 102°F. The next day the urine was dark brown (hemoglobinuria). On April 3rd she was given 500 cc. of blood after having received a test dose of the donor's plasma without reaction. Twelve hours after the transfusion a typical hemolytic reaction developed, with jaundice and dark urine. On April 8th the patient received 250 cc. of blood conditioned by Witebski's substance but again headache, nausea and hemoglobinuria developed.

It was decided to proceed with the operation of splenectomy and splenorenal shunt although it was obvious that there could be no blood replacement. It was hoped that with the good exposure obtained by the thoracico-abdominal approach it might be possible to carry out the procedure with minimal loss of blood. This proved to be the case. The operation previously described was performed on April 11, 1950. Operating time was three hours, forty-three minutes. The blood pressure at the beginning was 140/90 and at the conclusion 120/60. The patient received 500 cc. of plasma during the operation. Her convalescence from the operation was satisfactory and follow-up studies in September, 1950, showed improved liver function; there had been no further gastrointestinal bleeding and x-rays of the esophagus were negative for varices.

## SUMMARY

The logical treatment of portal hypertension is the creation of a shunt between the portal system and the vena cava. This may be accomplished by splenectomy followed with end-to-side anastomosis of the splenic vein to the renal vein with preservation of the kidney. This operation as well as the portacaval anastomosis on the right side is facilitated by use of a thoracico-abdominal approach.

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Crile and Brown were able to follow up carefully the late results of vagotomy in thirty-six of thirty-nine patients with marginal ulcer operated upon during the past four years. Three patients of the thirty-six studied were unrelieved. In all the others vagotomy apparently induced a cure; this seemed true regardless of whether the marginal ulcer occurred after gastroenterostomy or gastrectomy. Since this procedure is much simpler for the operator and the surgical risk is much less to the patient than when extensive gastric resection is performed, the authors justly conclude that vagotomy should be the preferred procedure in the surgical treatment of marginal ulcer. However, I personally would first like to try the effects of banthine and other drugs that produce a "chemical vagotomy." (*Richard A. Leonardo, M.D.*)

# Streamlined Articles

## CARCINOMA OF THE BREAST*

### THE DIAGNOSTIC SIGNIFICANCE OF PAIN

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*Chicago, Illinois*

THE complaint of pain in the breast has no direct significance in the diagnosis of carcinoma. Painful lump may be the complaint of up to 20 per cent of all those clinic patients later found to have carcinoma; delay in seeking medical advice is less for painful lump than for painless lump. The concept of carcinoma as a painless lump should not provoke delay in microscopic identification of a dominant lump found to be tender or described as the location of any kind of pain. Discovery of a lump because of associated pain or tenderness makes possible the earlier diagnosis of existing carcinoma; patients who seek treatment for breast symptoms but whose breasts do not show visible or palpable evidences of mastopathy may be instructed in self-examination. In the possible future some of these may find carcinomas in their own breasts while the lump is small and the stage of the disease is early.

* * * *

Improvement in the results of surgical treatment for carcinoma of the breast parallels earlier microscopic identification of the nature of a lump which may be palpable evidence of carcinoma not yet spread beyond the limits of the mammary gland. Duration of the tumor growth before accidental discovery by the patient and the degree of further extension during the period of delay before treatment is sought are variables not under the direct control of the physician. Relatively few patients admitted to the Breast Tumor Clinic of the Cook County Hospital are aware of the cancer significance of a lump in the breast. Fewer than one in a hundred have been previously instructed in the need, method or optimum periodicity of self-examination, and even fewer have ever practiced such examination. A majority of them ignore accidentally discovered lumps for months or years unless rapidly progressive skin change is noted or, more importantly, tenderness or pain is associated with the lump. We consider the complaint of pain in the breast to be indirectly important in the earlier diagnosis of carcinoma since it brings to us many patients who may then be instructed in self-examination. Our experience with the complaint of "painful lump" causes us to reconsider ideas previously held concerning the painlessness considered characteristic of carcinoma and fibroadenoma. Because pain, or pain with lump, caused our patients to seek advice sooner than did any other symptoms of breast disease and because the symptom receives scant attention in medical literature, we wish to consider here selected clinical observations on patients whose complaints included pain or tenderness, and to compare them with similar observations on those who complained of painless, non-tender lump.

During the twenty-two month period from August 1, 1947, to June 1, 1949, there were 574 indigent patients admitted to our clinic because of breast complaints. Among these were 236 (41.1 per cent) whose complaints were of pain, painful swelling or painful lump in the

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† Drs. Schairer and Tanoue, Solomon Fellows in Breast Surgery, 1948 and 1949. Drs. Carlson and Tope, American Cancer Society Fellows in Clinical Surgery, 1948 and 1949, Cook County Hospital.

breast. Seventy-four patients refused permission for biopsy or were otherwise lost to follow-up within a period of one year from the date of first examination; they are included in this study only to be listed among total complaints.

TABLE I

| Complaint | | Carcinoma | Benign Tumor | Chronic Cystic Mastitis | Inflammatory | No Breast Disease |
|---|---|---|---|---|---|---|
| Pain | (84) | 2* | 1† | 36 | 12 | 28 |
| Painful swelling | (25) | 1† | † | 1 | 16 | 2 |
| Painful lump | (94) | 24 | 21† | 19 | 14 | 6 |
| Lump | (220) | 78 | 60† | 27 | 9 | 11 |
| | 423 | 105 | 82 | 83 | 51 | 47 |

* Far advanced carcinoma.
† Do not include gynecomastia, 1, 2, 4 and 10 cases, respectively.

Surgical biopsy was performed for every dominant lump and in the case of every patient whose complaints included pain and who had palpable evidence of mastopathy; a total of 353 biopsies were performed among the 500 patients studied by the group for periods of one year or longer. In this group there were 205 patients (41 per cent) whose complaints had been pain, painful swelling or painful lump, 220 (44 per cent, who had entered the clinic because of a painless non-tender lump and seventy-five (15 per cent) who had mentioned a variety of complaints. One-third of those complaining of lump or painful lump were found to have carcinoma (92 per cent of all carcinomas found were in those whose complaint had included lump). There were 117 carcinomas not previously subjected to surgery elsewhere. Carcinoma, benign tumors, chronic cystic mastitis, nonpuerperal inflammatory disease and "No Breast Disease Found" comprised more than 80 per cent of all final diagnoses. We have restricted this study to the four complaints and five diagnoses previously mentioned, hence the numerical data will necessarily not tally. Table 1 indicates the relationships observed between complaints and final diagnoses.

The youngest patient included in this study was eight years old, and the eldest eighty-nine; approximately half of the patients were between twenty and thirty-nine years of age, and slightly less than one-third were between forty and fifty-nine. Six patients entered for the relief of symptoms arising during lactation. Sixty-four per cent were Negroes. There were twenty-six males, of whom two had carcinoma; the remainder had gynecomastia. Table 11 shows the age distribution of final diagnoses with reference to the admitting complaints of lump and painful lump.

TABLE II

| Decade | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Total admissions | (574) | 4 | 42 | 154 | 128 | 100 | 75 | 43 | 22 | |
| Followed up | (500) | | | 152 | 126 | 99 | 74 | 42 | 21 | 9 |
| Painful lump | ( 94) | 0 | 3 | 24 | 27 | 14 | 12 | 8 | 6 | 0 |
| Carcinoma | ( 24) | 0 | 0 | 0 | 5 | 5 | 6 | 6 | 2 | 0 |
| Benign | ( 21)* | 0 | 0 | 12 | 3 | 4 | 1 | 0 | 0 | 0 |
| Chronic cystic mastitis | ( 19) | 0 | 0 | 7 | 6 | 3 | 1 | 0 | 2 | 0 |
| Inflammatory | ( 14)† | 0 | 1 | 2 | 4 | 2 | 2 | 0 | 0 | 0 |
| No breast disease | ( 6) | 0 | 0 | 1 | 4 | 1 | 0 | 0 | 0 | 0 |
| Lump | (220) | 1 | 17 | 50 | 46 | 41 | 34 | 20 | 7 | 4 |
| Carcinoma | ( 78) | 0 | 0 | 2 | 8 | 21 | 24 | 17 | 8 | 5 |
| Benign | ( 60)* | 0 | 10 | 29 | 10 | 5 | 2 | 1 | 0 | 0 |
| Chronic cystic mastitis | ( 27) | 0 | 1 | 7 | 7 | 7 | 4 | 2 | 0 | 0 |
| Inflammatory | ( 9)† | 0 | 1 | 4 | 1 | 2 | 1 | 0 | 0 | 0 |
| No breast disease | ( 6) | 0 | 0 | 2 | 4 | 2 | 1 | 1 | 1 | 0 |

* Includes fibroadenoma, 18 and 52, respectively.
† Does not include puerperal breast disease.

The age incidence for the complaint of pain in the breast almost exactly parallels that for total admissions. A majority of those who complained only of pain described the distress as cyclic and premenstrual in occurrence or with premenstrual and menstrual aggravation. Even if the complaint was of unilateral pain, tenderness and/or palpable changes in breast texture could be discovered bilaterally. Five of these patients were no longer menstruating; two of these five had carcinoma. In their cases the pain was obviously from involvement of adjacent structures by far advanced tumors. The average interval between onset of the pain and admission to the clinic was 22.5 weeks.

The one carcinoma found among those patients who complained of painful swelling caused pain because of infiltration of the chest wall. Sixty per cent of these patients had inflammatory disease. The average interval between onset and admission was thirty-seven weeks.

Table 11 indicates that the percentage distribution and age incidence for carcinoma, benign tumors and chronic cystic mastitis are about the same for the complaint painful lump as for that of lump. Almost one-fourth of the patients whose original complaint included lump and in whose cases a microscopic diagnosis of carcinoma was made had complained of pain or tenderness associated with the lump.

Most described a dull aching, occasionally a smarting or stinging, pain. Among the five patients who still menstruated three stated that they had noted menstrual or premenstrual exacerbation; with the exception of this variation there were no essential differences in the distress described by patients complaining of painful lump whether the final diagnosis was carcinoma, benign tumor or chronic cystic mastitis.

Five of the twenty-four patients with carcinoma with painful lump stated that pain or tenderness had existed in the locality for variable periods before it led to the discovery of lump; one of these patients had carcinoma limited to the breast. Six gave identical durations for both symptoms and thought that pain or tenderness had led to the discovery of lump. Ten patients had known of the lump for varying periods before pain was noted and three were unable to estimate the duration of either symptom. In those who estimated durations that for lump averaged ten months, for pain three and a half months. (The average estimated duration of seventy-eight painless lumps was 17.5 months.)

Only six patients (25 per cent of those with painful lump) had carcinoma without demonstrable axillary spread, but this small number constituted 34.5 per cent of all proved group I cases in which the patients were operated upon by us during this period. (Group I carcinomas constituted 12.8 per cent of the total carcinomas treated during the period of study.) Ten of the twenty-four had carcinomatous axillary nodes, six had evidence of remote extension or extensive local growth when examined and two had had surgery elsewhere for primary lesions. The smallest clinical measurement recorded for any lump in this group was 1 by 1.5 cm.; the largest in group I or II measured 6.5 cm. in diameter. The average size was not importantly different from that of all our group I and II cancers. We are unable to find gross or microscopic variations in either the carcinomas or the character of breast tissue thereto adjacent by which we could account for the presence of pain and tenderness.

## COMMENTS

Carcinomas of the breast seen at the Cook County Hospital include a higher percentage of late and hopeless cases than are noted in reports from other clinics. Lay ignorance, indifference, neglect and temporizing delay from whatever cause are responsible for this unfortunate situation since few of these patients have consulted a private physician before coming to us. However, to most of them pain is a symptom exciting alarm and activating cancer phobia; hence this symptom is important to all those interested in the earlier diagnosis of carcinoma of the breast, as it provides contacts opportune for the dissemination of lay knowledge of cancer and promotion of the health-habit of self-examination. We are aware of the paramount cancer importance of palpation of a lump in the breast; data recorded here indicate that clinic patients report the finding of such a lump with less average delay if there is associated pain or tenderness.

We have not found carcinoma and fibroadenoma to be characteristically non-tender. Earlier we had thought this to be because cancers of the breast seen by us were, on the average, larger and further advanced than those examined at other clinics, and that perhaps pain and tenderness were characteristic of such late tumors. The average size of these tender tumors and the relationship they bore in stage of growth to the non-painful and non-tender tumors make it evident to us that the painfulness is not due to the involvement of adjacent structures. It may be that almost no truly small, early carcinomas are tender or painful. Our opinion, however, based upon experience in private practice, is that the group of patients with carcinoma of the breast seen in our clinic with the complaint of painful lump represents an average stage of growth and extension comparable to that encountered in private practice in this vicinity.

# FURTHER STUDIES WITH ULTRAVIOLET BLOOD IRRADIATION THERAPY (KNOTT TECHNIC) IN SEPTIC ABORTIONS*

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EXPERIENCE with forty patients having incomplete septic abortions indicate that it is logical and safe to perform dilatation and curettage with a sharp curet when using ultraviolet blood irradiation therapy as a protective measure.

Since July, 1938, a total of forty patients with postabortional sepsis have been treated at Shadyside Hospital with UBI† as an adjunct. Thirty-four patients were treated preoperatively and six within three days postoperatively. All cases were within the first three to four months of pregnancy. All patients had dilatation and curettage using a sharp curet. The observations reported in 1942[1] are supported by these additional cases in that with UBI as a protective measure it has been found safe to clean out an infected uterus thoroughly using a sharp curet.

* * * *

Beginning with 1942 nineteen patients have been added to the previous series of which seventeen received UBI preoperatively and two postoperatively. The recommended procedure is to administer UBI within twenty-four hours preceding dilatation and curettage and repeat the UBI as indicated, although one UBI is usually sufficient. A comparative work does not seem to be available in literature. The well-known hazard of using a sharp curet is still present despite modern antibiotic therapy because by the time the organism and its sensitivity can be determined serious delay has occurred in instituting specific therapy.

The reasons for this radical departure from previously accepted methods of treating septic abortion are the many cases of actual septicemia due to various pathogenic organisms which have recovered with no other specific therapy than UBI, and it has been found that all of the common pathogenic organisms can be inactivated by ultraviolet rays in the making of autogenous vaccines. This work was done with a modified Knott irradiation chamber and represented approximately 250 vaccines. It would seem logical then that the spread of infection both locally and into the blood stream when thorough curettage is done could be controlled by such a therapy. In practical application this has been a consistent finding. The safe, thorough removal of infected or necrotic material in the uterine cavity is certainly desirable.

The Knott technic consists of exposure of the patient's blood after citration to selected wave lengths of ultraviolet rays produced by a water-cooled ultraviolet generator. An average of 1½ cc. of blood per pound of patient's body weight is used and immediately pumped back into the same vein at a rate of 1 cc. every two seconds and subjected to intermittent exposure to ultraviolet rays.[2]

Table 1 shows certain data pertaining to the new series of patients. It will be noted that there was considerable difference in the average hospital and postoperative days between the patients on whom UBI was used alone and those in whom the sulfa compounds and/or penicillin were used. It seems that in this type of work UBI, when used alone, gives the best results. Clinical experience has shown that it is unwise to use photosensitive drugs such as the sulfa compounds with UBI. Apparently the use of antibiotic therapy with UBI is harmless, but in general the clinical results are not as satisfactory as when UBI is used alone in indicated cases.

An example of the combined use of UBI and sulfa compounds is Mrs. M., aged twenty-eight, Case No. 113447, admitted February 14, 1944, and discharged March 4, 1944. Admission temperature was 102.4°F. The uterus was cleaned out using a sharp curet the evening of

† UBI will be used for ultraviolet blood irradiation therapy (Knott technic).

* From the Shadyside Hospital, Pittsburgh, Pa.

admission, and twelve hours later UBI was administered. In spite of temperature and pulse dropping satisfactorily two days later the patient's physician elected to use sulfathiazole. No further UBI treatments were requested. ceived 2,750 cc. of whole blood by transfusion and was discharged on her nineteenth postoperative day. Experience would indicate that early repetition of UBI without sulfathiazole would have saved this patient much morbidity.

TABLE 1

CERTAIN DIAGNOSTIC CRITERIA IN NEW SERIES

| Hospital Number | History of Criminal Abortion or Vaginal Packing | Admission Temperature | Peak Temperature | Leukocytes over 12,000 or Polymorphonuclears over 75% | Pathogenic Organism in Blood or Uterus | Dilatation and Curettage (Sharp Curet) | Irradiation Preoperatively | Irradiation Postoperatively | Sulfa Therapy with + or - Penicillin Therapy | Hospital Days | Postoperative Days | Mortality |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 158696 | Yes | 99°F. | 99.8°F. | Yes | Both negative | Yes | 1 | - | - | 6 | 5 | - |
| 95456 | Yes | 98.6°F. | 100.2°F. | Yes | Uterus, Esch. coli | Yes | 1 | - | - | 12 | 11 | - |
| 137306 | Yes | 99.8°F | 99.8°F. | No | Uterus, Esch. coli | Yes | 1 | - | - | 5 | 5 | - |
| 100567 | No | 102°F. | 103°F. | Yes | Uterus, Staph. aureus | Yes | 1 | - | - | 4 | 4 | - |
| 102164 | Yes | 100.2°F. | 102.8°F. | No | Both negative | Yes | 1 | - | - | 6 | 5 | - |
| 96573 | Yes | 103°F | 103.4°F. | Yes | Both negative | Yes | 1 | - | - | 6 | 4 | - |
| 97644 | No | 102°F. | 102°F. | Yes | Both negative | Yes | 1 | - | - | 7 | 6 | - |
| 99411 | Yes | 101.6°F | 101.6°F. | No | Uterus, Esch. coli | Yes | 1 | - | - | 5 | 4 | - |
| 150884 | No | 98°F | 103°F | Yes | Blood, Str. viridans | Yes | 1 | 2 | - | 15 | 13 | - |
| 131776 | Yes | 99.8°F. | 99.8°F. | Yes | Uterus, streptococcus | Yes | 1 | - | - | 5 | 4 | - |
| 148449 | No | 100°F. | 102.4°F. | Yes | Uterus, Esch. coli | Yes | 1 | - | - | 8 | 6 | - |
| 98532 | No | 99.8°F. | 102.4°F. | Yes | Both negative | Yes | 1 | - | - | 4 | 4 | - |
| 146169 | No | 99.4°F. | 101.6°F. | Yes | Not taken | Yes | - | 1 | - | 7 | 3 | - |
| 92329 | No | 100.4°F. | 100.4°F. | Yes | Both negative | Yes | 1 | - | - | 6 | 5 | - |
| 175618 | No | 99.8°F. | 99.8°F. | No | Both negative | Yes | 1 | - | - | 7 | 4 | - |
| | | | | | | | | | Average | 6.8 | 5.5 | |
| 113447 | Yes | 102.4°F. | 106°F. | Yes | Blood negative | Yes | - | 1 | + | 19 | 19 | - |
| 144631 | No | 100°F. | 101.4°F. | Yes | Blood negative | Yes | 1 | 1 | + | 9 | 8 | - |
| 105510 | No | 103°F | 103°F. | No | Blood negative | Yes | 1 | - | + | 8 | 4 | - |
| 112402 | No | 101°F. | 103°F. | No | Blood negative | Yes | 1 | - | + | 13 | 7 | - |
| | | | | | | | | | Average | 12.2 | 9.5 | |
| | | | | | | | | | Grand Average | 8.0 | 6.3 | |

The patient received 360 gr. of sulfathiazole plus 130,000 units of penicillin. Her temperature ranged up to 106°F. the eight and ninth postoperative days, and reached normal on the eleventh postoperative day. The patient re-

Mrs. W., aged forty-eight, Case No. 112402, received two preoperative UBI treatments on the second and seventh admission days, and postoperatively she received 895 gr. of sulfathiazole. Her temperature reached normal on

her fifth postoperative day. She stayed fourteen hospital days including seven postoperative days.

Mrs. S., aged twenty-six, Case No. 144631, had 2,350,000 units of penicillin and two UBI treatments postoperatively. Her temperature

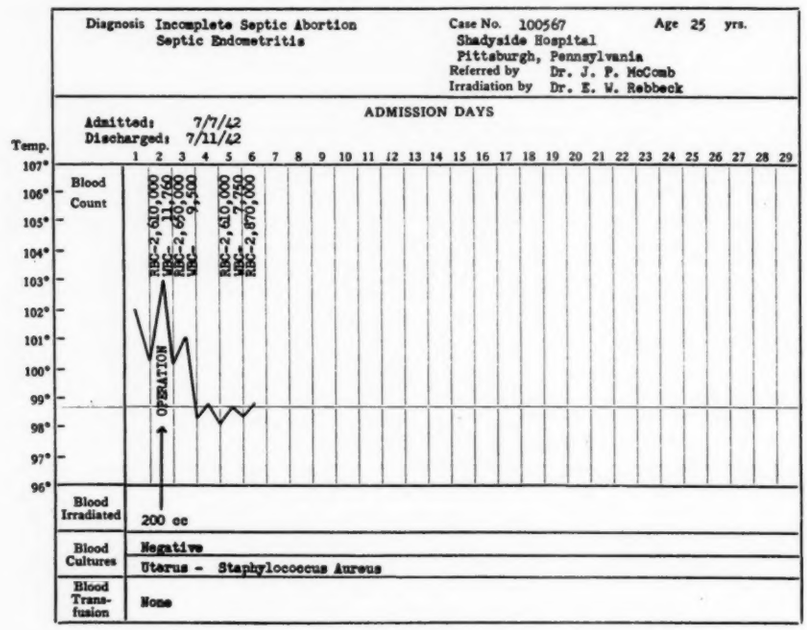


FIG. 1.

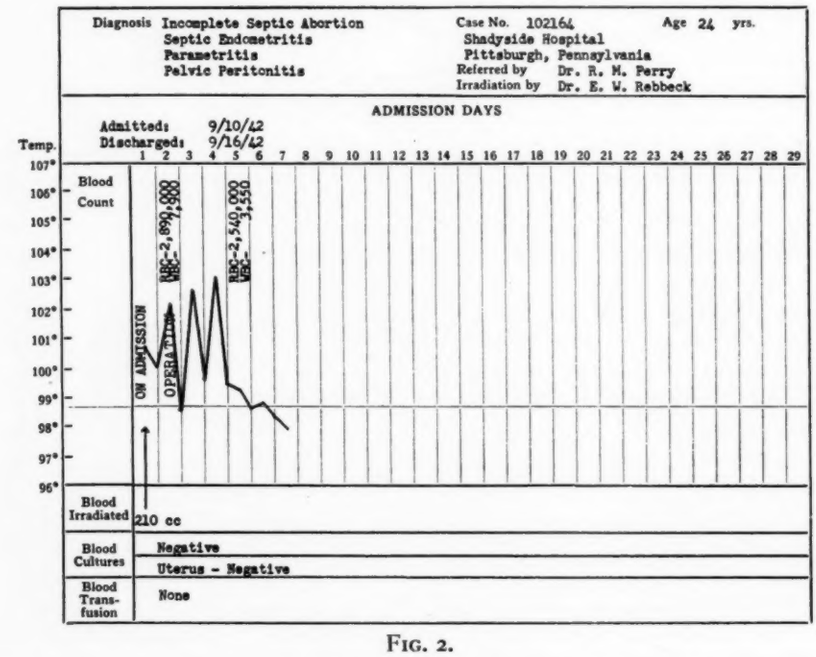


FIG. 2.

Mrs. K., aged thirty-seven, Case No. 105510, had 135 gr. of sulfanilamide preoperatively and one preoperative UBI treatment. Her temperature reached normal on the third postoperative day. She stayed eight hospital days including four postoperative days.

reached normal on the eighth postoperative day. She stayed nine hospital days including eight postoperative days.

None of the remaining patients had other than UBI. Three interesting brief case histories are presented:

Mrs. M., aged twenty-six, Case No. 100567, was admitted July 7, 1942, and discharged July 11, 1942. This patient had a history of a normal menstrual period April 25th and the onset of daily bleeding with mild cramps prior to admission. The day before admission profuse bleeding occurred with severe backache. Her admission temperature was 102°F., pulse 120. She was quite toxic on admission. The fact of interference was never admitted but was under suspicion. The patient received UBI on the morning following admission, and because of active bleeding dilatation and curettage with thorough cleaning out of the uterus was done shortly afterward. Uterine culture at operation subsequently showed Staphylococcus aureus. The patient made an uneventful recovery and was discharged on the fourth postoperative day. Her physician reported check-up of the pelvis about a month later to be normal. In this instance the uterine infection was apparently limited. (Fig. 1.)

Mrs. J., aged twenty-four, Case No. 102164, was admitted September 10, 1942, and discharged September 16, 1942. She had a history of having inserted a penholder tip into the uterus about one week prior to admission. She was presumably about two months pregnant at the time. Bleeding and lower abdominal pain ensued, the pain becoming severe prior to admission. On admission there was marked tenderness with moderate rigidity throughout the pelvis. No masses were palpable. This patient had at least septic endometritis with parametritis and probably pelvic peritonitis. She received UBI on September 10th. The uterus was thoroughly cleaned out on the following day, and as shown in Figure 2 she made an uneventful recovery. The pelvic tenderness was gone on discharge and no residuals were found at recheck. In this instance the uterine culture was negative.

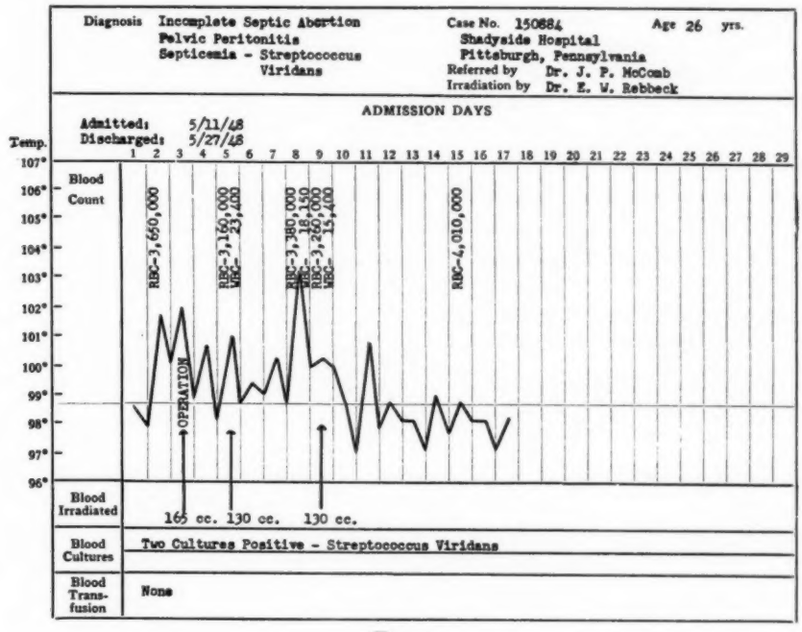


FIG. 3.

Miss K., aged twenty-six, Case No. 150884, represents a more advanced pathologic condition. She was admitted May 11, 1948, and discharged May 27, 1948. This patient presented marked pelvic tenderness and rigidity and was approximately three months pregnant when an incomplete abortion occurred. She would not admit interruption. The case is interesting because of the fact that pelvic peritonitis was present as well as septicemia due to Streptococcus viridans. As shown in Figure 3 three blood irradiation treatments were given before recovery which then progressed uneventfully, and her recheck showed no residuals. This type of case handled under any other method could have ended in a fatality or at least prolonged morbidity.

There was no mortality in the entire series

when UBI was used as recommended in conjunction with thorough curettage with a sharp curet, and the morbidity was remarkably low.

The following types of organisms were recovered either from the uterine cavity or blood stream in this series: Escherichia coli, hemolytic streptococcus, non-hemolytic anaerobic streptococcus, indifferent streptococcus, Str. viridans, Staph. aureus, diphtheroids, pneumococcus. Transient bacteremia occurred in three patients in whom blood cultures were taken immediately postoperatively. In these patients the blood stream was sterile twenty-four hours later. These organisms represented two indifferent streptococcus cases and one pneumococcus, type undetermined. Two patients recovered from septicemia due to Esch. coli and Str. viridans, respectively. Thirty-two non-septic incomplete abortion patients without associated bacteremia were given UBI prophylactically in conjunction with dilatation and curettage and uniformly uneventful recoveries ensued.

## SUMMARY

1. Forty patients having incomplete septic abortions were treated with UBI and dilatation and curettage using a sharp curet, with remarkably consistent recoveries.

2. Thirty-four of these patients had UBI within twenty-four hours before operation.

3. Six patients were given UBI within three days postoperatively after dilatation and curettage because of symptoms of uterine infection with high fever.

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# BREAST BIOPSIES*

## A STUDY OF OVER FOUR HUNDRED CASES

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*Chicago, Illinois*

IN this article the authors will present a study of 432 consecutive breast biopsies over a ten-year period which discloses that on the average one of six masses will be malignant. This ratio increases in the younger age groups but reaches equality in the sixth decade of life.

On an average approximately 20 per cent of these patients who present themselves with a suspected breast mass will give a history of menstrual, menopausal or other gynecologic disorders. This was not considered diagnostically significant.

The application of frozen section in breast biopsy as a means of diagnosis is limited; the training and experience in pathology will enable the surgeon to diagnose approximately 80 per cent of the lesions grossly at the time of operation. The remaining questionable lesions are best studied by paraffin section in which accuracy is more important than a delay of forty-eight to seventy-two hours in applying definitive therapy.

* * * *

The application of surgical resection for solitary masses occurring in the breast as a method of diagnosis has become increasingly important within the last few decades. Both the profession and the public have recognized the importance of making an early positive diagnosis in all questionable cases of breast tumors. The following study was undertaken in order to evaluate from several aspects the value of the breast biopsy method as a means of making an early diagnosis. To this end several questions were presented as the basis for this study. First, it was considered as informative to find the percentage of cases in which the biopsy proved to be malignant in a long-range consecutive series. This would give the clinician a better opportunity to prognosticate the relative frequency of malignancy in solitary breast lesions on initial inspection. Secondly, also studied was the possible relationship between finding the mass in the breast and concomitant or previous gynecologic and obstetric disorders. This relationship has often been stressed but the actual percentage of instances has not usually been stated. Thirdly, since our method of study was standardized, it was considered valuable to ascertain whether gross inspection, frozen section or paraffin section was the most applicable and accurate method to be used. For this latter problem questionnaires were sent to all sections of the country in order to gain an unbiased over-all picture with which to compare our own. In every instance possible the discussion was limited to these essential problems. The ability to recognize grossly the pathologic lesion lying dormant in the breast is a function of the surgeon as well as the pathologist. Although the only reliable basis for a final diagnosis is an adequate microscopic study, gross inspection will definitely limit the number of possibilities when the size, location, palpatory characteristics and the patient's age are taken into consideration.[4] This only emphasizes again the need for a good foundation in general pathology for every surgeon; such training finds its greatest application in surgery of the mammary gland since it offers the surgeon-pathologist an opportunity to make an accurate reliable gross diagnosis in a very high percentage of cases.

### MATERIAL AND METHODS

A survey was made of a ten-year period extending from June, 1940, to June, 1950, of all surgical cases in which the procedure consisted of biopsy of a solitary breast mass. In a few instances there was more than one mass in the breast involved; however, the biopsy was taken from the section or mass that was most suspicious. Therefore, in each instance it could be considered that the surgical procedure was performed for a singular mass. In this period 432 instances of breast biopsies were recorded of which 381 were performed on inpatients and fifty-one cases were classified as outpatients.

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Those classified as outpatients differed only in the respect that the preoperative study was not always as complete as the majority group. In all instances the surgical procedure consisted of resection of the mass involved *en toto* and primary closure of the operative wound.

TABLE 1

| | | | |
|---|---|---|---|
| Mammary Tissue Origin | Benign | Parenchymatous hyperplasia | 159 |
| | | Fibroadenoma | 124 |
| | | Duct papilloma | 14 |
| | | Gynecomastia | 9 |
| | | Apocrine tissue | 2 |
| | Malignant | Scirrhous carcinoma | 38 |
| | | Comedo carcinoma | 23 |
| | | Medullary carcinoma | 14 |
| | | Mucinous carcinoma | 0 |
| Non-mammary Tissue Origin | Benign | Lipoma | 24 |
| | | Fibroma | 10 |
| | | Inflammatory tissue (non-specific) | 5 |
| | | Sebaceous cyst | 3 |
| | | Abscess (non-specific) | 2 |
| | | Sweat gland adenoma | 2 |
| | | Nevus | 1 |
| | Malignant | Reticulum cell sarcoma | 1 |
| | | Neurofibrosarcoma | 1 |
| | | Total | 432 |

The specimens were immediately placed in 10 per cent formalin and sent to the laboratory where in a period of forty-eight hours paraffin hematoxylin-eosin stains were performed. The pathologic microscopic picture was then observed and an attempt at a positive diagnosis of the specimen made. On all specimens that were diagnosed as malignant the patient was returned to surgery in seventy-two hours and definitive treatment was performed consisting of either simple or radical mastectomy. In a great majority of instances records indicated postoperative irradiation was performed. There were no instances of preoperative irradiation noted.

On the basis of the microscopic diagnosis all the specimens were classified pathologically. The classification is given in Table 1. It is well to emphasize that many of the cases did not present a clear-cut microscopic picture. A great majority of the malignant tumors disclosed areas of lobular hyperplasia and fibroadenomatous change as well as evidence of acute or chronic inflammation. All of the benign cases showed a variety of combinations of the four classifications listed. In each instance the case was placed in that category in which the microscopic section showed the most prominent consistent picture. Thus, as for instance in a case which showed mostly lobular hyperplasia and perhaps singular areas of fibroadenomatous or duct fibroma type changes, the final diagnosis was lobular hyperplasia. To simplify the classification of these pathologic changes further, all lesions were classified as being of mammary tissue origin, i.e., from the ductal and acinar epithelium and fibrous tissue or of non-mammary tissue origin, realizing full well that such a classification is an artificial division but one that was best suited for our study.

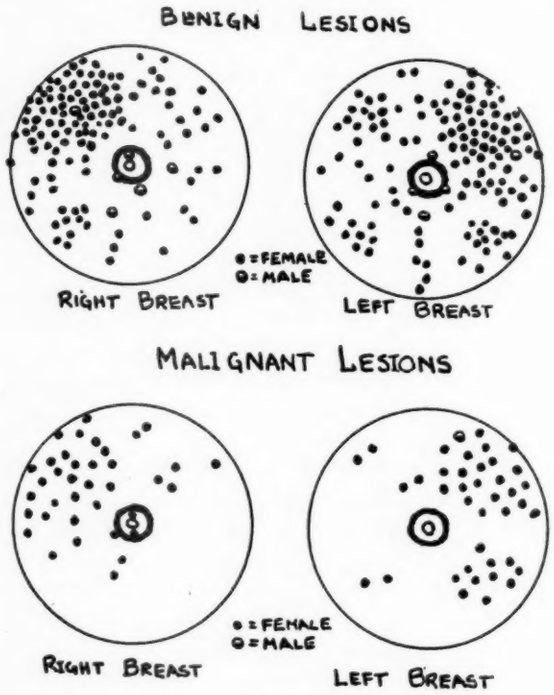


FIG. 1.

Of the 381 instances in which complete history, physical examination and laboratory work-up were recorded these case histories were profiled as to age of patient, sex, menstrual history, obstetric and gynecologic history, matrimonial status and family history. Also, in each one of the latter series the site and duration of the lesion and associated symptoms referable to the lesion were recorded. A composite picture of the lesions is shown in Figure 1. In all the cases in which the diagnosis proved to be malignant an attempt was made to follow up and record the present status of the patient and to evaluate the duration of the probable cure.

In addition, since our technic and subsequent handling of breast biopsies were standardized as to extent and variation, questionnaires were sent to pathologists and surgeons in various

sections of the country. It was considered valuable to get the opinion of both the pathologist and the surgeon as to definitive therapy for biopsy specimens.

## RESULTS

Of 432 patients 417 were females and fifteen were males.* The pathologic diagnosis was benign in 357 cases and malignant in seventy-seven cases, indicating that approximately one of six breast biopsies proved to be malignant (15.5 per cent). About one-half of the procedures were performed on the right breast and the other one-half on the left. Thirteen cases were bilateral breast biopsies, all of these proving to be benign.

There has been a definite increase in the number of procedures performed, this increase being noticed in the yearly totals. From June to December, 1940, there were twenty cases; in 1941, thirty; 1942, twenty-nine; 1943, thirty-four; 1944, thirty-eight; 1945, forty-six; 1946, forty-three; 1947, forty-three; 1948, fifty-five; 1949, fifty-three; and January to June, 1950, forty-one. This indicates an increased interest and awareness of the possible dangers associated with solitary breast masses.

Of the tumors of mammary tissue origin the four most common benign neoplasms were, in order of frequency, lobular hyperplasia, fibroadenoma, lipoma and duct papilloma. In order of frequency the three most common malignant lesions were scirrhus, comedo (or duct) carcinoma and medullary carcinoma. No mammary tissue sarcomas or Paget's disease was found in our cases. There were nine instances of gynecomastia. Table 1 indicates the other less common lesions that were noted.

Figure 2 indicates that from the twenty to forty year age group the greatest number of biopsies were taken and the relative malignancy was from two of 100 to five of 100. Although a lesser number of breast biopsies were taken from the forty to eighty year age group, the instance of malignancy increased so that the ratio was 1:1 in the fifty to sixty year age group, 3:1 in the sixty to seventy year age group, and 2:1 in the seventy to eighty year age group. This indicated that although fewer biopsies were performed in the older age groups the chance of their being malignant was much greater.

Duration of symptoms prior to entry into the hospital varied from three days to twenty years so that these figures are not conclusive except to show the relative importance attached to lesions of the breast by some patients. It should also be appreciated that in most instances the duration of symptoms dated from the time the patient noted the lesion and did not necessarily reflect the actual time the lesion began.

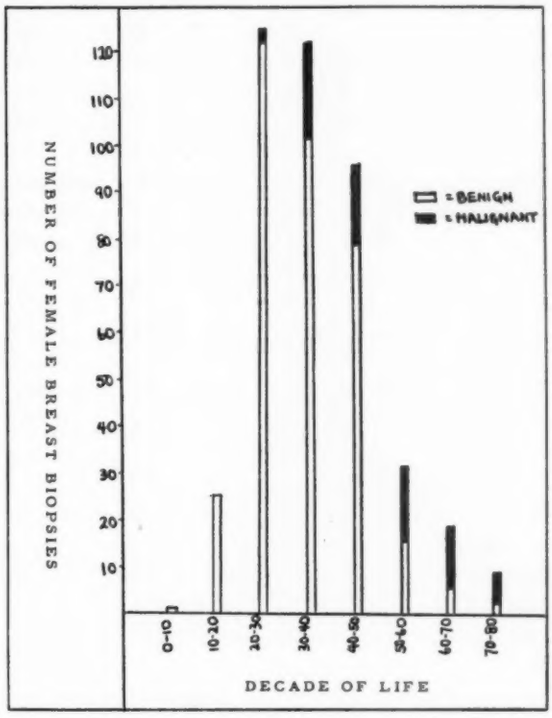


FIG. 2.

The relationship to various gynecologic procedures indicated that approximately 28 per cent of those women with benign lesions had some gynecologic surgery performed and about 33 per cent of those with malignant lesions had this type of surgery. The procedures were usually uterine suspensions, partial or complete unilateral oophorectomy for ovarian cysts, hysterectomies and perineorrhaphies. Fifty-two per cent of those patients with benign lesions had borne children whereas 62 per cent of those with malignant lesions had borne children. In both benign and malignant cases from 11 to 18 per cent had menstrual irregularities, the higher figure being that of the malignant cases. Of the benign cases 13 per cent of the patients

* Of the fifteen male patients nine had gynecomastia, three had duct papilloma and there was one case each of neurosarcoma, lipoma and lobular hyperplasia.

had had their menopause; of those patients with malignancy 49 per cent had had their menopause. In 11 per cent of the benign cases there was a family history of malignancy as compared to 18 per cent of the malignant cases. In three instances of malignancy the mother had a history of carcinoma of the breast. There was no significant finding between breast feeding and a tumor mass. In nine instances tumors which developed during pregnancy proved to be benign. In eight instances the mass in the breast followed pregnancy.

Plotting of the site of the lesions indicated that in the benign cases there was no special quadrant or section of the breast that would be of diagnostic value. In the cases in which males were involved most of the lesions were under or just next to the nipple area. This is understandable since the male mammary tissue does not grow outward to any great extent from the circumferential area of the nipple. In those cases which proved to be malignant the lesions were more prominent in the outer upper and outer lower quadrants although several instances of malignant lesions were noted in both the inner upper and inner lower quadrants.

In answer to the questionnaires to evaluate the importance of gross diagnosis, frozen sections and paraffin sections the results were as follows: When asked if a diagnosis could be made on a gross specimen on biopsied breast, of seventy-seven answers to 100 letters sixty-one pathologists stated they could make the diagnosis in 85 to 90 per cent of cases, whereas of seventy-two answers to 100 letters thirty-seven surgeons said they could make the diagnosis in the same percentage of cases. When asked if they would condone radical mastectomy on the basis of such gross diagnosis thirty-seven pathologists and fifteen surgeons said that they would. The letters from the surgeons seemed to indicate a greater reliance on microscopic section. When asked if frozen sections were frequently made at their respective institutions, the results seemed to indicate that these sections were used in 75 to 80 per cent of all institutions over the country. This indicates that although the gross diagnosis could often be made a great reliance was placed on frozen sections in these institutions. The reasons for this were several. Many answers indicated that frozen sections were used chiefly as a teaching procedure for the resident and intern staff and that most pathologists would actually prefer a paraffin section when the gross diagnosis was doubtful. Secondly, several queries stressed the fact of the medicolegal aspect in that if radical mastectomy were performed at the first procedure on the basis of a gross diagnosis the occasional case in which a breast would be amputated for a benign lesion could possibly lead to a litigation. Other institutions which did not use frozen sections used nipple smear preparations or punch and/or needle biopsies. Both pathologists and surgeons indicated by their comments that the ability to make a gross diagnosis in a breast biopsy and perform an immediate radical mastectomy was in direct proportion to the training and experience of the surgeon, and that if there was any doubt the pathologist should be called in on consultation at the time of the procedure.

The follow-up study of the seventy-seven cases of malignancy disclosed forty patients to be alive, twenty-nine known dead and eight unreported. With all types of therapy the average postoperative course was three and a half to four years in those patients who expired. Of the group living there are nineteen five-year survivals; in the same group there are twenty-five three-year survivals.

## COMMENTS

Our data disclose that when a patient presents herself to the physician for an examination of a suspected breast mass there is one chance in six that the mass will be malignant; the ratio increases in the younger age group and approaches equality in the sixth decades of life. Our percentage of malignancy is low as compared to series reported by Jones,[5] and Penner and Wilt.[7] Of the seventy-seven instances of malignancy there was no definite increase in the number of five-year survivals when compared with much larger surveys,[1,2] our own cases falling into the stage I or stage II categories. This indicates that breast biopsy is valuable from a negative viewpoint; it rules out malignancy but does not change its prognosis as to duration of life.

A profile study of the pathologic diagnoses listed in Table I is not remarkable save for the high incidence of benign lipomas. The question was raised as to whether the biopsied specimen was inadequate as to size or incorrectly localized at surgery. This did not prove to be the case as a follow-up study showed that in all

twenty-four instances no evidence of malignancy subsequently occurred (to date).

Although the hormonal influence of the female generative organs on the breast tissue have been adequately stressed,[8] the relationship of masses in the breast to menstrual, gynecologic and obstetric history in our series did not prove to be diagnostically significant, with the exception that the greater percentage of patients with malignancy were past the menopause as compared to those whose masses were benign. On the other hand, there was a family history of cancer in 20 per cent of the total number of cases. There were, however, only three instances in which a genetic relationship between mother and daughter was present as to carcinoma of the breast.

The ability to make a correct gross diagnosis of a biopsied breast specimen approaches 80 per cent accuracy in the hands of a surgeon well trained in pathology. The use of frozen section can add very little more to that percentage because of limitations imposed by the thickness of section, size of tissue which can be adequately cut in a frozen state by microtome and less than ideal absorption of tissue stains. In addition, when a lesion of questionable gross malignancy is present, the slight delay in time between the less accurate frozen section and the more accurate paraffin section does not warrant immediate definitive therapy.[6] Consequently, when the gross specimen does not lend itself to an inspection diagnosis, it is better to close the biopsy wound primarily and wait forty-eight hours for the paraffin section report; this, of course, relegates the frozen section to the background as an accurate means of early diagnosis but it does not lose its place as an excellent teaching method for breast pathology. On the other hand, when the gross diagnosis of cancer can be made by inspection (and this can be done in the greater majority of cases), logical application of radical surgical procedures while the patient is still under the anesthetic is indicated. This is where the experience and training of the surgeon come to the fore and enable him to give the best possible service to his patient.

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# Case Reports

## INTRAHEPATIC CHOLANGIOJEJUNOSTOMY WITH PARTIAL HEPATECTOMY*

### REPORT OF A SUCCESSFUL CASE

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IN five cases I have found it expedient to perform an intrahepatic cholangiojejunostomy as described by Longmire and Sanford[1] for the relief of biliary tract obstruction. Four of these five patients had advanced carcinoma which had produced either a primary or secondary blockage of the hepatic portal. Moreover, the extrahepatic biliary tract was inaccessible for any side-tracking procedure. All four patients were jaundiced and complained of intractable pruritis. They expired between the tenth to sixtieth postoperative days. One patient died of cholemia. It is interesting to note that three of these patients were completely relieved of their jaundice and itching following surgery.

Regardless of this discouraging experience with hopeless cases it was still believed that this procedure had a limited although very definite place in the armamentarium of every general surgeon. Completely obliterated extrahepatic biliary tract radicals and accidental injuries to the portal vein near the hilus of the liver are experiences which most operators will eventually encounter. The following case is reported because it demonstrated a method of managing a combination of surgical complications which would have precipitated a surgical fatality prior to the advent of intrahepatic cholangiojejunostomy.

#### CASE REPORT

J. H. M., a forty year old farmer, was admitted to the hospital on February 14, 1950. He complained of pain in the right upper abdominal quadrant, chills and periodic attacks of jaundice.

History revealed that this man had had a cholecystectomy for what sounded like typical gallstone colic one year prior to this admission. He stated that he became deeply jaundiced immediately after this procedure and was extremely ill but did not have pain. The jaundice began to subside in the third postoperative week. The patient remained asymptomatic until June, 1949, four months after operation for the removal of his gallbladder. On this occasion he again became deeply jaundiced, had fever and "passed voluminous, foamy, gray-colored stools." The patient had pain in the right upper quadrant and itching of his skin which was disabling for about thirty days. Following this episode he had mild, recurrent febrile attacks but remained fairly well for an additional four months. In November, 1949, he noted a recurrence of the same sequence of events that he had experienced in June. The jaundice, fever and itching persisted but the patient was only partially incapacitated. Five days before the present hospital admission he became acutely ill with severe right upper quadrant pain and chills. Antibiotics, sedatives and antispasmodics were not effective. His family physician recommended hospitalization.

Upon physical examination the patient appeared to be acutely ill. His scleras were clear but his skin had an icteric tinge. The liver border extended 6 cm. below the costal margin and was diffusely tender. There were no other pertinent findings on physical examination. His temperature on admission to the hospital was 102°F. The hemoglobin was 12.45 gm. Erythrocytes numbered 3,580,000 per cc. and the leukocyte count was 8,700. The serum bilirubin was 2.6 mg. and the icterus index was 28.5 units. Bromsulphalein dye test revealed a 1 plus retention of the dye and the quantitative prothrombin was estimated to be 100 per cent

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of normal. Urinalysis was normal and the urinary urobilinogen was positive 1 to 5.

The patient was given two 500 cc. transfusions of whole blood and massive doses of penicillin to prepare him for surgical exploration.

Operation was performed on February 17th. Pontocaine, subarachnoid block and cyclopropane were used for anesthesia.

The abdomen was entered through an upper transverse incision. The right lobe of the liver was markedly enlarged and contained multiple abscesses varying in size from 1 mm. to 8 cm. in diameter. They could be seen protruding from the surface of the liver. These lesions had not penetrated Glisson's capsule. A small nodule was excised and sent to the laboratory for frozen section tissue examination. The pathologist reported that the specimen was a localized inflammatory process. The material from one of the larger masses was aspirated. It appeared to be odorless pus.

The omentum, duodenum and a portion of the hepatic flexure of the colon were adherent to the undersurface of the liver. These structures were separated from the liver by blunt and sharp dissection. The peritoneum on the lateral surface of the duodenum was divided and the duodenum was rotated medially. It was impossible to find the common bile duct. There was, however, a string-like fibrous band present which extended from the second portion of the duodenum up into the hilus of the liver. The liver parenchyma was dissected away from this structure for a distance of 2 cm. into the hilus of the liver. At this point a dilated bile duct was encountered. A mucosa-to-mucosa cholangioduodenostomy was accomplished over a polyethylene tube. Two layers of fine interrupted silk suture were used for the anastomosis and the suture line was re-enforced with omentum.

The right lobe of the liver was mobilized and a large abscess in the dome of the liver was aspirated. The liver capsule over this inflammatory process was resected so as to "unroof" the abscess completely. It was possible to demonstrate that this necrotic cavity extended down to within 1 to 2 cm. of the hilus of the liver by palpating the polyethylene tube that had been placed in the cholangioduodenostomy anastomosis. Rather brisk bleeding ensued but subsided when oxycel gauze was placed around the edges of the cavity. The small and medium-sized liver abscesses were left undisturbed. Three Penrose drains were placed in the abscess cavity and one Penrose drain into Morison's pouch. The former were brought out through a stab wound above the transverse incision and the latter through a separate stab wound beneath the incision. The wound was closed in layers with continuous chromic catgut tension sutures and silk.

The patient's postoperative course was uneventful for the first ten days. There was a moderate amount of seropurulent drainage around the Penrose drains in the dome of the liver. Fluid balance was maintained with parenteral glucose, saline and Darrow's solution. The patient received 1,000,000 units of crystalline penicillin each twenty-four hours. On February 28th the drainage from the stab wound leading to the liver became more profuse and soon assumed the characteristics of duodenal contents. Constant suction was applied but the drainage persisted and increased in amount. The drainage collected from the duodenal fistula was frequently 3,000 cc. in a twenty-four hour period. The patient became more of a nutritional and fluid balance problem each day. On March 31, forty-one days after the first operation, a second one was performed.

The second operation was carried out under cyclopropane and curare anesthesia. The abdomen was entered by making an elliptical incision around the fistulous tract with the drains *in situ*. The tract was followed down to the right lobe of the liver. This portion of the liver was then mobilized. The multiple abscesses seen at the time of the patient's previous operation had completely disappeared. The cholangioduodenostomy was intact but the opening in the duodenum communicated directly with the old abscess cavity in the right lobe of the liver. The polyethylene tube in the opening was removed and the duodenum separated from the bile duct stump. The opening in the duodenum was then closed with one layer of fine catgut and one row of cotton suture placed through the muscular and serous walls of the duodenum. The open bile duct was doubly ligated with chromic catgut and the drains in the liver were removed. The incision was then extended to the left. The left triangular ligament of the liver was divided and the left lobe of the liver delivered into the wound. Mattress sutures of heavy chromic catgut were placed through the substance of the liver proxi-

mal to the triangular ligament. The left lobe of the liver was then excised. A large bile duct was encountered near the center of the remaining portion of the lobe. Green bile was aspirated from this structure.

The jejunum was divided 30 cm. from the ligament of Treitz. The proximal end of the distal loop was brought through the transverse mesocolon and anastomosed to the bile duct protruding from the cut surface of the left lobe of the liver over a polyethylene tube. Two rows of fine chromic catgut suture were used for this procedure. An attached portion of the greater omentum was sutured to the raw liver surface. Gastrointestinal continuity was re-established and the biliary drainage loop defunctionalized by anastomosing the distal end of the proximal jejunal loop to the side of the distal loop 15 cm. from the cholangiojejunostomy anastomosis. One row of fine chromic catgut and one row of cotton suture material were used for this procedure. A drain was placed at the upper end of the right and left peritoneal gutter and brought out through stab wounds. The wound was closed in layers with fine catgut, cotton and silk.

The patient's postoperative course was quite stormy for the first ten days. On the tenth postoperative day a right subphrenic abscess was drained by excising a portion of the end of the eleventh rib. His convalescence following this was uneventful. Since that time the patient has been seen periodically, has regained his normal weight and maintained an excellent nutritional status.

## SUMMARY

It is realized that intrahepatic cholangiojejunostomy is an operative procedure of considerable risk and magnitude. Moreover, as noted in the first four cases mentioned, it may be performed for the purpose of relieving biliary tract obstruction in patients with very distressing symptoms with the additional hope of prolonging their lives.

However, as demonstrated by the report of this last patient, an intrahepatic cholangiojejunostomy may be a life-saving procedure and should have a definite, although limited place, in the armamentarium of every general surgeon.

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# ACUTE TORSION OF GALLBLADDER

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THE paucity of the literature available on acute torsion of the gallbladder leads one to believe that the condition is quite rare. Standard surgical textbooks have little or no account of the condition and a review of the literature reveals that only fifty cases does occur, the condition may become rapidly catastrophic if not recognized and if operation is not performed early. However, when one considers that this condition is most prevalent in elderly individuals in whom at times well advanced generalized peritonitis is recognized

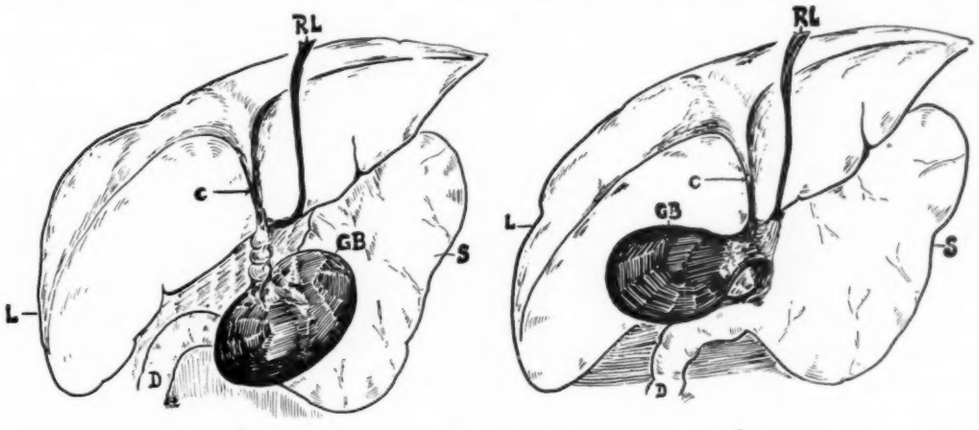


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FIG. 1. Schematic representation of acute torsion of the gallbladder with twists in the pedicle.
FIG. 2. Schematic representation of the gallbladder with long pedicle after release of torsion.

have been recorded since 1898 at which time the first case was reported by Wendel.[1] It is questionable whether all the cases recorded were true torsions of the gallbladder because in several instances the gallbladder was not removed. I believe one should make a differentiation between acute torsion and axial rotation of the gallbladder. Axial rotation can occur only in an abnormally situated gallbladder with a pedicle; and if the rotation does not completely compromise the blood supply to the gallbladder, it may give symptoms only temporarily and then with the release of the rotation the symptoms subside completely only to return again with repeated axial rotation. If the rotation is persistent and progressive and the blood supply to the gallbladder is completely interrupted, the condition becomes one of complete torsion with subsequent gangrene of he gallbladder.

Torsion or axial rotation of the gallbladder cannot occur in a gallbladder that is in normal position and situation. When acute torsion only with difficulty, some cases may go unrecognized and unreported. This case is presented as contributory evidence of another of the many bizarre behaviors of the gallbladder. The rarity of the condition warrants its publication.

## CASE REPORT

F. G., a thirty-eight year old male (No. 3015), had been in apparently normal health until November 1, 1950, at which time he experienced severe acute pain in the right upper quadrant soon after having had his lunch. The pain was intermittent until 3 P.M. at which time it became quite constant and did not radiate. The patient then became nauseated and vomited.

Examination of the patient at this time revealed the presence of an adult, healthy, white male apparently in acute distress, non-toxic and quite apprehensive. The temperature was normal and the pulse 100 per minute. The abdomen was scaphoid and markedly spastic

FIG. 3. Marked extravasation of all blood elements into the wall of the gallbladder; mucosa completely destroyed.

in the right upper quadrant, with tenderness on deep palpation over the region of the gallbladder. No mass could be palpated. It was my impression that the patient might have a penetrating or perforating ulcer in spite of a negative past history for peptic ulcer. He did have a history of jaundice in 1940.

The patient was admitted to St. Vincent's Hospital and the laboratory data were as follows: Blood count: red blood cells 4,710,000 with 96 per cent hemoglobin; white blood cells 10,900 with 78 per cent polymorphonuclear cells. Urinalysis was negative. The patient's temperature was 100°F. and the pulse 100 per minute. X-ray of abdomen proved negative for presence of air below the diaphragm.

The general condition of the patient did not change, however; he continued to complain of exquisite pain in the upper abdomen and soon began to vomit again. The abdominal signs became more localized with definite point tenderness over the gallbladder even after the patient had received adequate sedation. Again there was no mass palpable at this time.

It was persistence of acute abdominal pain over a period of six hours with undisputable point tenderness that prompted surgical intervention. The negative past history for peptic ulcer and the positive history of jaundice complicated our attempt to make a diagnosis. However, apart from the precise diagnosis the clinical picture could not be interpreted as anything but an acute condition of the abdomen necessitating immediate operative intervention. To recognize an acute condition of the abdomen is of material consequence because although it is always desirable to appreciate the patient's ailment with as much detailed exactitude as human understanding will allow, in this particular instance our conduct was influenced by the knowledge that had been acquired and the execution of proper surgical judgment.

Laparotomy performed within four hours after admission to the hospital and seven hours after onset of symptoms revealed the presence of a black, distended gallbladder with three twists in its elongated pedicle. Some blood-tinged fluid was present in the abdominal cavity. The gallbladder was free in the abdomen overlying the distal end of the stomach. There was no bed in the liver for the gallbladder but a definite cleft in the right lobe was present where the gallbladder bed would be expected. The pedicle was attached to the lower end of the cleft and then over to the hepatoduodenal ligament. (Fig. 1.) When the gallbladder was palpated and delivered upward, it was noted that the twists in the pedicle were in counterclockwise fashion and that they were the cause for the complete occlusion of the blood vessels to the gallbladder with subsequent infarction of the entire gallbladder wall. After releasing the twists both the gallbladder and its long pedicle were free in the abdominal cavity. The pedicle contained the cystic vessels and a long cystic duct. (Fig. 2.)

Cholecystectomy was performed with ease; a drain was placed down to the cystic stump and the abdomen closed in layers. The patient made an uninterrupted recovery and was allowed home on the ninth postoperative day.

Pathologic report revealed the following: The specimen was a tense and cystic gallbladder (6 by 4 by 4). The surface was smooth and purple. The wall was thick and dark. The mucosa was finely granular and purple-black. The lumen contained blood and clots but no stones. Microscopic report revealed there was marked hemorrhage through all layers which completely destroyed the gallbladder wall. (Fig. 3.) The diagnosis was infarction of the gallbladder.

## COMMENT

This case has been the second one encountered by the author within two years. The previous one although dramatic was not as classical as the case herein reported. The patient was an elderly female ninety-three years of age who had had intermittent attacks of pain in the right upper quadrant for several days with nausea and vomiting. She presented a very elusive mass in the right upper quadrant. This mass eventually became constant in its loca-

tion, the pain more severe; and because we suspected progressive acute suppuration of the gallbladder, laparotomy was performed under local anesthesia. A large, dusky, distended, freely movable, edematous gallbladder, not typical of the inflammatory type, delivered most easily into the operative wound bringing a very long pedicle up flush with the skin surface. Because of the age of the patient and the difficulty with anesthesia it was thought wise to complete our operation with dispatch so that the pedicle was amputated *en masse* at the skin level without further exploration of the abdomen. Retrospective analysis of the symptoms, progress and operative findings led us to the conclusion that the patient had had repeated attacks of axial rotation of the gallbladder, but never sufficiently long to compromise the blood supply of the gallbladder completely and develop gangrene.

It was the fact that we were suspicious of the presence of an acute suppurative process in the gallbladder which might perforate that prompted surgical intervention. This is a point that requires some emphasis. It was most fortunate that the patient had not developed the rapid gangrenous process which we had experienced with the case presented herein because during the period of observation perforation would have unquestionably developed with the ensuing complication of bile peritonitis.

In evaluating our clinical findings another point worthy of note was the fact that although the patients were obviously in distress and appeared most apprehensive of some impending disaster they did not appear toxic as one would naturally expect with acute suppurative cholecystitis. In our present case the persistence of pain with definite localized point tenderness after the administration of opiates made us suspicious of a definite pathologic condition requiring surgical intervention.

With the previous history of jaundice in this case the differential diagnosis was made more difficult. Cholelithiasis was of course suspected and in spite of the negative scout abdominal x-ray films for air a penetrating or slow perforating ulcer could not be excluded.

## REMARKS

Varied abnormalities in position of the gallbladder may be present in an individual without symptoms for a long period of time, only to be discovered during a routine x-ray examination. In people with long-pedicled gallbladders the condition may never interfere with the health of the individual until acute torsion or repeated attacks of axial rotation occur. In some others it may only be an incidental finding in the autopsy room. (Fig. 4.) In the majority of cases the gallbladder is in a shallow fossa on the undersurface of the liver and only its fundus and posterior surface are covered with peritoneum. The presence of a mesentery is not normal and according to Brewer it is found in about 5 per cent of dissected cadavers; however, this high incidence is not in accord with other anatomists and certainly not with our surgical experience. In fact the presence of a true pedicle is very rare and the specimen photographed in Figure 4 is the first one I had ever seen in a cadaver.

FIG. 4. Photograph of gallbladder with long pedicle in a cadaver; note potential degree of mobility of gallbladder.

*Anatomy.* The gallbladder is intimately associated with the liver in its development. The liver is formed as a diverticulum from the ventral surface of the foregut. This diverticulum grows forward into the septum transversum and gives off solid buds which form the right and left lobes of the liver. The original diverticulum from the foregut forms the bile duct, and from this the cystic duct and gallbladder are developed as an outgrowth or evagination. This outgrowth is normally of such a length that only its distal end (the fundus) comes to lie below the level of the anterior border of the liver. In very exceptional

cases, however, it is so elongated that the whole of the ultimate gallbladder lies below the anterior border of the liver and the fossa for the gallbladder is occupied by the lengthened cystic duct. In these circumstances the gallbladder is completely invested with peritoneum and hangs freely in the abdomen; unless this very rare anatomic abnormality is present true torsion cannot occur.

In certain cases the peritoneal relations are such that the gallbladder is attached to the liver by a double fold of peritoneum which forms a mesentery. No doubt this will allow of considerable movement of the gallbladder and axial rotation, but no complete torsion can take place. With regard to torsion the peritoneal arrangements are of little significance compared with the all important relation of the gallbladder and cystic duct to the liver. Although abnormalities of the bile ducts have been carefully studied, very few statistics appear to have been published on anomalies of the gallbladder. Brewer (1899) states that in 100 dissections of the gallbladder and biliary ducts he found five cases in which the gallbladder was attached to the liver by only a double fold of peritoneum, but no record is given of any case in which the gallbladder was attached to the liver merely by the pedicle of the cystic duct and vessels. The latter condition must be extremely rare, and torsion in these circumstances becomes such a simple matter that one would infer that it must almost inevitably occur. The mechanism producing it would appear to be the movements of the gastrointestinal tract.

*Mechanism of Torsion.* In most of the reported cases of torsion the presence of a mesentery was noted. This mesentery was obviously attached only to part of the gallbladder rather than the entire gallbladder thus allowing the organ to be free in the abdominal cavity. Some clinicians have postulated that the active waves of peristalsis that occur in the fasting stomach before a dinner go from left to right and tend to rotate the full gallbladder in a clockwise fashion. A protective spasm of the rectus muscle is then initiated and this contraction would tend to keep up the torsion rather than undo it. Other men believe that the cause of the torsion is related to the movement of normal peristalsis in the transverse colon and that would be from right to left thereby causing rotation in a counterclockwise manner. The nature of the twist has been counterclockwise much more frequently than in the opposite direction. If a patient has a true long pedicle permitting unrestrained migration of the gallbladder, it is conceivable that a sudden twisting body motion might initiate axial rotation. The presence of stones in the gallbladder does not appear to be a predisposing factor in precipitating rotation or torsion because the majority of cases recorded did not have cholelithiasis.

*Age and Sex.* The majority of patients reported have been elderly females; however, a certain number have occurred in younger women. One case report was that of a girl eleven years of age and Wendel's patient was only twenty-three years old. The female I referred to in my report was ninety-three years old. Only six cases have been reported in males, most of whom were elderly individuals. The case reported herein is the youngest one on record.

*Symptomatology.* Most of these people as a rule have enjoyed good health until the time of the torsion. Previous history may reveal suspicious evidence of some gallbladder disturbances. Jaundice is most unusual.

The symptoms are usually sudden in onset with colicky pain in the mid-epigastrium or in the right upper quadrant; this pain remains persistent and is sustained if the torsion is progressive. If the torsion is not complete, the pain may become remittent and recur at varied intervals. Nausea and vomiting are usually present. The pulse and temperature are normal at the onset but both will become elevated with the onset of gangrene. A point worthy of note is the fact that in spite of the exquisite pain and accompanying symptoms the patient does not appear toxic when first seen.

In most cases a definite mobile, soft, rounded, smooth tumor is palpable in the right upper quadrant. The right rectus becomes spastic as the process in the gallbladder becomes progressive. Point tenderness will remain constant with the onset of gangrene just the same as it would with a loop of gangrenous bowel and this was well demonstrated in our patient. The presence of a mobile tumor was well illustrated in the case of the elderly woman referred to in our report. It has been stated that acute pain and vomiting without jaundice in an elderly female and the appearance within a few hours of the onset of the greatly enlarged and palpable gallbladder are highly suggestive.

If the disease is allowed to progress from infarction to complete gangrene of the gallbladder, the patient's general condition deteriorates and generalized peritonitis will follow. This has occurred in a surprisingly small number of the cases recorded.

Delay in operation over forty-eight hours will cause a fatality. The reason for delay is the supposition that the underlying pathologic condition is acute cholecystitis which may resolve. However, a careful history with accurate observation of the clinical findings may obviate this error in diagnosis and defer further procrastination.

Cholecystectomy is the only treatment for acute torsion of the gallbladder and is accomplished with great ease for obvious reasons. In some cases in which there was axial rotation without damage to the gallbladder or its blood supply the surgeon attempted to immobilize the gallbladder by applying stabilizing sutures between the gallbladder and surrounding structures.

SUMMARY

1. A case of acute torsion of the gallbladder with gangrene is described and a brief report is given of another personal experience with axial rotation of the gallbladder.

2. Acute torsion and axial rotation of the gallbladder should be considered as two separate conditions.

3. Preoperative diagnosis is possible if a careful history is obtained and accurate clinical observations are noted.

4. The non-toxic appearance of the patient with definite point tenderness should make one suspicious of acute torsion of the gallbladder.

5. Early cholecystectomy is the procedure of choice and care must be taken here as in all branches of surgery so that clinical judgment shall not be allowed to be subservient to any particular symptom or sign or laboratory report.

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# GIANT CELL TUMOR OF THE ILIUM*

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GIANT cell tumors are a group of tumors of bone with a typical pathologic picture, clinical features and roentgenologic appearance. These tumors represent true neoplasms of bone as they produce new tissue, recur locally and occasionally produce metastases. As Stewart[27] suggested, a more accurate name is osteoclastoma, if one understands that the name does not mean the tumor is derived from adult osteoclasts but rather from bone cells whose function is osteoclastic rather than osteoblastic.[1] As Willis[1] points out, embryologically the primitive mesenchymal or reticulum cell gives rise to all the cells concerned in the production of bone: fibroblasts, chondroblasts, osteoblasts, osteoclasts and marrow cells. In certain conditions these cells are interconvertible. Thus an osteoblast may become an osteoclast by perhaps some change in the enzyme system. In all probability osteoclasts are formed by fusion or fusiform or stellate monocucleated cells.

Giant cell tumors of the pelvic bones are uncommon. The following case represents the first case of this type of tumor in the ilium at the Jefferson Hospital.

## CASE REPORT

R. B., a forty-three year old widow, was admitted on August 28, 1948, to the Jefferson Hospital with the chief complaint of a large mass in the area of the right ilium. She stated that she had been perfectly well until December, 1947, when she first noted the mass as a small swelling in the area of the right anterosuperior iliac spine. Since then the mass had grown steadily in size. There was no history of pain or tenderness. She had not lost weight and was able to perform her work as usual. There was no history of trauma. She sought medical aid because she feared the mass was cancerous.

Family and personal medical history were non-contributory. Physical examination revealed a well nourished, well developed, white woman in no distress. The only significant finding was the grapefruit-sized mass that was firm, fixed and not tender in the anterior part of the right ilium. Laboratory reports showed the blood count, urinalysis, blood proteins, calcium, phosphorus, alkaline phosphatase, bromsulfalein excretion, urea clearance and sedimentation rate to be within normal limits. Wassermann and Kahn tests were negative. Roentgen studies showed presence of a huge mass, partially bony, arising from the ilium on a broad base between the superior and inferior spines. A fairly well demarcated calcium rim was present. Its internal architecture was predominantly non-osseous although some bony trabeculae did course through it. The radiologist's impression was that the mass was a chondromatous bone tumor. Films of chest and spine were normal.

On September 2nd, under continuous spinal anesthesia, the patient was operated upon by one of us (W. T. L.). An oblique incision was made over the mass. The abdominal muscles and iliacus were reflected upward and the glutei, tensor fascia lata, sartorius and rectus femoris were reflected down. The tumor mass was cut away widely with a moderate amount of bleeding. The two muscle groups were attached to each other and the wound closed primarily. The patient received 1,000 cc. of blood and 1,000 cc. of 5 per cent dextrose in normal saline during the 110 minute procedure. The patient left the operating room in good condition. The postoperative course was uncomplicated. The patient was kept in bed for fourteen days because of the extensive muscle repair. The wound healed primarily. She was discharged to her family physician on the eighteenth postoperative day. Postoperative x-ray studies showed the tumor to have been completely removed. Follow-up studies at six, twelve and eighteen months revealed no evidence of recurrence.

The pathologic report was as follows: The specimen consisted of a single, large, roughly spherical piece of tissue measuring 12.5 cm. in greatest diameter and weighing 400 gm. This mass of tissue seemed to be poorly circum-

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scribed and its surface was extremely irregular, with tags of tissue recognizable as fat and muscle tissue present. The mass had a distinct grating sensation to palpation and here and there throughout the mass many hard but movable areas could be palpated. The mass was cut with difficulty and with a distinct grating sensation, revealing a cut surface which presented an extremely variegated appearance. The mass was completely surrounded by an outer 1 cm. layer of a white, tough, fibrous capsule. There was an inner, thin, hard, 1 mm. layer of rough irregular bony material. One-half was given over to a well circumscribed, smooth, dark red, gelatinous-appearing area measuring 7.0 cm. in diameter. The remainder of the specimen was more or less hollowed out and was composed of a great deal of soft, mushy, friable, pinkish red material in which many small, sharp spicules could be palpated. The histologic diagnosis was giant cell tumor of the bone.

COMMENT

Giant cell tumors of bone were first described by Cooper and Travers[9] in 1818. Paget[10] wrote a detailed description of these tumors in 1853. In America Samuel Gross[17] analyzed seventy cases in which he emphasized the benign nature of most of these tumors but realized a few underwent malignant change; he also pointed out the modern idea of the interchangeability of bone cells and that the giant cells were derived from the formative cells of bone tissue. Bloodgood[28] in 1919 spoke of the benign nature of these tumors, advised conservative treatment and proposed the name "giant cell tumor" in place of giant cell sarcoma as the tumor had previously been called. Steward[27] in 1922 advised the name of osteoclastomas for these tumors.

About 20 per cent of all bone tumors are osteoclastomas.[11] The American Registry of Bone Sarcoma lists one giant cell tumor to two osteogenic sarcomas. At Jefferson from 1923 to 1943 there ave been twenty-five cases of osteochondroma, thirty-two cases of muscle and fascia sarcoma, forty-three cases of osteogenic sarcoma, four of Ewing's tumor, one adamantinoma and only sixteen cases of giant cell tumor. From 1943 to 1950 nine more giant cell tumors have been treated. The distribution is as follows: femur, eight; tibia, two; fibula, two; bones of foot, three; humerus, two; mandible, four; maxilla, two; sacrum, one; ilium, one.

In most large series tumors were evenly divided between the sexes. Most of these tumors develop before the age of thirty, but they have been reported from the age of four months[12] to sixty-eight years.[17] The majority of the tumors occur in the third decade.

Although every bone in the body has been involved, about one-half of these tumors arise in the lower limb and one-quarter in the upper limb. The tumors occur at the ends of long bones as a rule, where they arise in the metaphysis as Willis[1] has pointed out. The remaining one-quarter arise in the bones of the head and trunk. In the skull[26] the tumors follow the distribution of the cartilaginous centers of ossification. The disease is not uncommon in the mandible and has been reported in sesamoid bones.[24] The most commonly affected bones are in order of frequency the distal end of the femur, proximal end of the tibia, distal end of the radius, proximal end of the humerus, distal end of the ulna and proximal end of the fibula.

These tumors represent true neoplasms as they produce new tissue, recur and may produce metastases. Trauma[5] occasionally seems to be a factor in the primary growths; it also does seem to affect recurrences after therapy.[6]

Early, these tumors are uniformly red or brown, soft and friable; their appearance has been likened to "currant jelly." Older tumors are altered by fibrosis, cyst formation, hemorrhage, pigmentation, yellow necrosis or calcification. At first these tumors cause uniform destruction of the cancellous bone but later they may grow irregularly. Trabeculae are present early but later are destroyed. Cortical bone and joint cartilage are resistant; even when the bone is completely gone, the periosteum remains as a limiting membrane. There is little periosteal reaction. Occasionally tumors do cross joint spaces. Microscopically the mixture of fusiform or rounded cells and multinucleated giant cells with absence of any signs of bony differentiation is characteristic. The giant cells, the osteoclasts, measure up to 100 $\mu$ or more in diameter and contain many nuclei which are identical with those of the mononucleated cells. Appearances suggest that the osteoclasts are formed by the fusion of mononucleated cells. The vascularity varies greatly. The thin-walled vascular channels are surrounded by tumor cells. Changes due to

hemorrhage, pigmentation, cysts, fibrosis and foam cells are often marked.

Most osteoclastomas are benign but will recur after incomplete local removal. However, a few of these tumors will invade adjacent tissues and metastasize. Jaffe[7] tried to determine which tumors were malignant by classifying the cells of the stroma. This classification is at times helpful; but as Willis[1] and Russell[5] point out, osteoclastomas, like other groups of tumors, show a range of structure and behavior, and a few, not initially distinguishable from their benign fellows, invade and metastasize. This malignant behavior does not presuppose any essential change of growth; it is a property from the beginning of certain members of the class. Finch and Gleave[30] (1926) and Dyke (1931) reported cases in which the metastases closely resembled the benign tumors.

Pain is usually the first symptom although pathologic fracture may be the first manifestation. Evidence of a tumor mass may not be apparent for months. Tenderness is usually absent or slight. Advanced cases with paper-thin shell give the "egg shell" crackling sign. Bruits may be heard in the more vascular tumors. Pulsation is rare.[16,17]

Radiographic appearance is so characteristic in typical cases that some authorities as Brailsford[31] say biopsy is unnecessary. There is an osteolytic lesion, centrally or asymetrically placed, at end of long bone. This expanded cystic area is surrounded by a thin cortical shell which is usually continuous. The joint is not involved, but a thin area of sclerosed bone usually develops beneath the articular cartilage. The margin of the tumor is sharply defined. Trabeculae are seen in early tumors which have the so-called "soap bubble" appearance. There is little or no periosteal reaction. The tumor does not extend down the shaft as a rule but may break through the cortex. The tumor may jump a joint space in advanced lesions, especially in hip and vertebral joints.

Although roentgenologic studies have a higher percentage of correct diagnoses in osteoclastomas than in any other bone tumor, biopsy is advised before treatment is given. Aspiration biopsy is often adequate.

Bone cysts occur at an earlier age and tend to be down the shaft from the metaphysis; symptoms are absent or mild. By x-ray cysts show tendency to progress from end of bone as epiphyseal growth continues. Osteoclastomas have a clear demarcation by a sharp semicircular line which cysts do not have. Chondroblastomas show areas of calcification and occur in younger patients. Willis[1] believes these are a variety of giant cell tumor. Hyperparathyroidism presents multiple lesions with increased calcium and phosphatase and decreased phosphorus. Plasma cell myeloma may closely simulate osteoclastoma.[32–35] Biopsy is needed here. Central chondromas usually occur in the center of the shaft of short bones, are more spherical and are surrounded by sclerosed bone; they are often multiple. Osteosarcoma in its osteolytic form may require biopsy. Metastatic cancer from silent cancers will require biopsy.

All the authorities agree that excision of the tumor is the treatment of choice when this procedure is possible, as in the fibula, distal end of ulna, proximal end of radius, ribs, clavicle and patella, or where reconstructive procedures can be performed. However, due to the location of the tumor, excision is often impossible. Curetting and filling the cavity with bone chips are advised in this case.[6,13,19,34,46] Recurrence after this local operation is unfortunately not infrequent. Kolodny[19] estimated this to be as high as 20 per cent. Treatment by curettement at Jefferson in seventeen cases that we have been able to follow up is at least 20 per cent. Treatment of recurrences by high voltage x-rays is sometimes difficult because the x-rays do hinder new bone formation. Review of the literature of the last twenty years shows a marked increase in use of high voltage x-rays in the treatment of osteoclastomas[2–4,14,21–24,36–41,45] because there is less recurrence, disability is no more than that from surgery, there is no danger of infection, and the capsule of the tumor is preserved. It is the belief of the authors that high voltage x-ray therapy is the treatment of choice when excision is impossible. Tumors that show malignant characteristics should be treated with radical surgery. Malignant change in irradiated bone may occur after many years,[6] but this is uncommon. Radical surgery is indicated if this occurs.

In general, the outlook is good. The histology of the tumor is the most important factor according to Jaffe and others.[7] In general, the older the patient, the more uncertain the outcome.[6] Tumors about the knee are more often malignant than on the small bones.

SUMMARY

1. A case of osteoclastoma of the ilium treated successfully with excision is presented.

2. Review of the literature suggests that high voltage x-ray is the treatment of choice when excision is impossible.

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Recently ligation of the inferior vena cava (below the level of the renal veins) has often proved to be a life-saving procedure in patients in whom pulmonary emboli develop from thrombi in the veins of the pelvis or lower extremities. However, according to a recent study by Shea et al., serious and disabling late and untoward sequelae often result. Consequently, these authors justly conclude that the inferior vena cava should be ligated only in patients who have already experienced multiple pulmonary infarctions and who otherwise are apt to die. They strongly believe this procedure is followed with too many and too serious and disabling late sequelae to justify its routine use in the prophylaxis of thromboembolism. Some of these untoward sequelae are pain, recurrent leg ulcers, trophic changes, intermittent claudication, edema of extremities, eczema, nocturnal cramps in the legs, venous stasis (despite evidences of establishment of collateral venous circulation), persistent tenderness in the calves, fatigue and other disabilities directly traceable to vena cava ligation that caused many patients to become at least partially, and perhaps permanently, disabled for their regular work. (*Richard A. Leonardo, M.D.*)

# ISLET CELL TUMOR OF THE PANCREAS*

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PATIENTS with insulin-producing tumors of the pancreas were first operated upon by Mayo[1] twenty-five years ago although Harris[2] had described spontaneous hyperinsulinism in 1924. It was Graham[3] who first successfully removed an insulin-producing tumor of the pancreas in 1929. Since then nearly 400 tumors of the pancreas, associated with hyperinsulinism, have been described.

The effect of removal of islet cell tumors upon the blood sugar is well known with the exception of the immediate postoperative period. In the case reported later the blood sugar was found to be markedly changed within a few moments after excision of the tumor tissues. The frozen section report and the blood sugar value were used during surgery as criteria of completeness of removal of hyperinsulinism-producing tissues.

Benign or malignant islet cell tumors of the pancreas show a wide range of variability as to size, multiplicity and location in or about the pancreas.[4-6] (Fig. 1.)

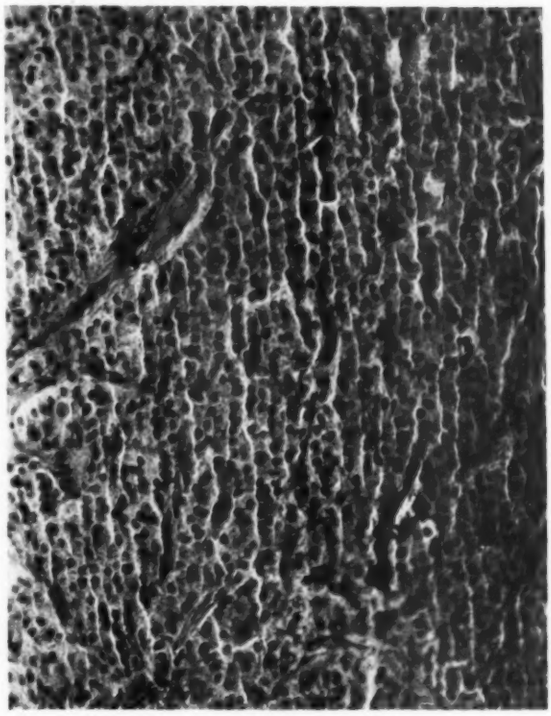

FIG. 1.

The diagnosis is quite certain when episodes of coma or motor incoordination occur after a period of fasting, associated with a blood sugar of less than 50 mg. per cent, and followed with recovery after the ingestion of sugar.[7] The glucose tolerance curve is normal or shows considerable individual variation.[6,7] Complete surgical excision of such a tumor usually results in cure if the lesion is benign but is prone to recurrence when malignant.[8-10]

## CASE REPORT

A twenty-two year old white secretary was admitted to St. Luke's Hospital on April 11, 1949, with a history of afternoon episodes of syncope. This occurred as often as two or three times a month during the previous year, with recent increased frequency of occurrence. These episodes of syncope occurred several hours after eating, usually in the afternoon, and were not associated with an aura or known convulsive movements. The patient had been aware of some emotional depression and an increase of 15 pounds in weight. There was no history suggestive of any other endocrine dyscrasia and past history was non-contributory. The admission physical examination was essentially normal for a twenty-two year old female weighing 158 pounds.

The laboratory data were as follows: Urinalysis was normal; red blood cells, 3,990,000; white blood cells, 7,500; hemoglobin, 12.0 gm.; lymphocytes, 33; monocytes, 4; polymorphonuclears, 52; eosinophils, 1; basophils, 1; bands, 9; sedimentation rate, 32 mm./60 inches; cholesterol, 170; non-protein nitrogen, 27 mg. per cent; fasting blood sugar, 50 mg. per cent; cephalin flocculation, 1 plus; thymol turbidity, 2.3 units; total plasma protein, 8.12 gm. per cent; plasma albumin, 4.25 gm. per cent; plasma globulin, 3.86 gm. per cent; basal metabolic rate, plus 4; blood type, "B" Rh negative; Kahn test was negative; glucose tolerance, 50,108,134,116,81, and 44 mg. per cent with no glycosuria. The average fasting

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preoperative blood sugar was 32.6 mg. per cent. X-ray examination of the skull revealed no evidence of an hypophyseal tumor or other pathologic disorder and a two meter chest film was normal.

The clinical course was as follows: On the day after admission, following a period of fasting for eight hours, the patient became irrational, drowsy and could be aroused only by painful stimuli. There was some diaphoresis but her pulse and blood pressure remained normal. A blood sugar during this reaction was 27 mg. per cent. The administration of 250 cc. of orange juice orally resulted in the patient's becoming rational within a few moments and she identified the reaction as similar to those which she had experienced during the previous year. Similar attacks were provoked during the two succeeding days with blood sugars of less than 40 mg. per cent with a positive response to orange juice or intravenous glucose. On the seventh hospital day the patient was subjected to an abdominal operation for the removal of a pancreatic adenoma. On exposing the pancreas through the gastrocolic ligament, a nodular area in the tail of the pancreas seemed on gross examination to be an adenoma. Examination also revealed two small accessory spleens in the colosplenic ligament. It was elected to remove approximately one-half of the pancreas (30 gm.).[11] Postoperatively, the patient made a satisfactory recovery but showed no improvement in her fasting blood sugar or periods of syncope. The patient required frequent supplementary feedings of glucose in order to remain alert. Routine examination of the surgical specimen revealed normal pancreatic tissue. Therefore, on the patient's fourteenth hospital day (seventh postoperative) the abdomen was again opened and the two accessory spleens were removed.[5] Histologic examination of these tissues by the frozen technic revealed splenic tissue but no pancreatic tissue. Reexamination of the head and remaining body of the pancreas revealed no palpable masses. The duodenum was then freed from the head of the pancreas with partial mobilization of the remaining pancreas. Palpation revealed a small nodule about 1 cm. in diameter in the head of the pancreas beneath the second portion of the duodenum. A blood sugar taken at this time was 131 mg. per cent during an infusion of 5 per cent glucose in distilled water. The nodule was excised and immediate histologic examination revealed tissues characteristic of a benign islet cell tumor of the pancreas. Within thirty minutes after excision of the tumor the blood sugar was found to be 258 mg. per cent.

The patient made a satisfactory recovery under temporary diabetic management and was discharged from the hospital three weeks following the second operation, with a fasting blood sugar of 89 mg. per cent and without a single episode of fainting or syncope. She has remained well during the past two years except for a single episode of pancreatitis without alteration in blood sugar values.

The pathologic report revealed the mass consisted of a bean-shaped nodule 1.2 by 1 by 0.9 cm. Surfaces made by cutting were moderately firm, grey tissues with a nodule of tan brown lobulated tissue 8 by 3 by 3 mm. at one edge. Histologic sections of these tissues were unique in structure. There were cellular tissues composed of alveolar masses of cells that were medium in size and arranged in mosaics, separated by narrow or broad hyalin fibrous tissue septa. The cells had a granular, rather pale cytoplasm and vesicular nuclei with chromatin granules. There were no tubules but simply aggregates of cells which varied in size and resembled the islet cells of the pancreas. At the periphery there was a small quantity of compressed pancreatic tissue with acini.

The hyperinsulinism in this case was caused by a tumor measuring 8 by 3 by 3 mm. located in the head of the pancreas beneath the second portion of the duodenum. It is obvious that such a tumor or tumors might easily be overlooked on gross examination by the surgeon or by the pathologist unless serial sections were made. This was the reason for failure at the initial surgery in spite of removal of 30 gm of pancreatic tissue. The fortunate finding of a pancreatic tumor in the second laparotomy did not insure success because these tumors are occasionally multiple. However, after obtaining a markedly elevated blood sugar, after removal of a histologically proven tumor, there was reasonable assurance that the cause of hyperinsulinism had been removed. There was no such elevation of the blood sugar after the initial surgery.

SUMMARY

A case is presented of successful surgical treatment of a single benign islet cell tumor

of the pancreas associated with severe hypoglycemia and hyperinsulinism. Blood sugar determinations during the operation shortly before and after excision of the pancreatic adenoma were of value in determining the completeness of removal of hyperinsulin-producing tissue.

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The reader may be surprised to learn that Baber et al. recently reported operative and autopsy findings on an advanced case of adenocarcinoma that started in the cervix of a fifteen month old infant. Surely "chronic irritation" was not an etiologic factor in this case, and this makes us wonder sometimes if it is always of importance in adults with cervical cancer! (*Richard A. Leonardo, M.D.*)

# FAMILIAL MULTIPLE LIPOMATOSIS*

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FAMILIAL multiple lipomatosis is sufficiently rare to justify reporting the occurrence of three cases of this disorder in two generations of a family. Review of the literature reveals that twenty-four families have been studied and reported since this malady was first described in 1857 by Murchison.[19] Table 1 is a compilation of these case histories and shows their number is too small to justify drawing any definite conclusions as to the incidence or heredity of this disorder; however, certain trends are suggested. It is noted that some patients were reported to have only one or two tumors; and since single lipomas are so common, it is not unlikely that these tumors occurred by coincidence alone. However, the occurrence of many tumors in more than one member of a family is probably not due to chance. Likewise, the fact that the affliction frequently involves more than one generation suggests that the disease is inherited.

That no more than three generations of a single family have been known to have familial multiple lipomatosis need not be taken as evidence against the fact that the disease is hereditary. It has been suggested that two genes are concerned in the transmission of the disorder and it may be that the necessary genetic relationship is lost after two or three generations. Perhaps, although unlikely, the disease may cause so little inconvenience that it escapes attention.

Most authors have emphasized the fact that the disease occurs predominantly in males; in this collection of cases there were forty-seven males and only twenty-eight females. However, the number of cases is probably too small to be statistically significant. There is no specific age at which the tumors can be expected to appear; in some families the lipomas made their appearance at puberty or early adult life while in others they developed after the age of forty.

It has been pointed out that the lipomas frequently show a symmetrical distribution and occasionally a linear pattern corresponding to the course of peripheral nerves similar to that seen in multiple neurofibromatosis. In fact, it may be difficult to differentiate the two without the aid of biopsy. There does not seem to be any special area of predilection.

It has been suggested that the disease is an error of metabolism as evidenced by an elevation of blood cholesterol.[4] Of the five cases in this collected series in which cholesterol studies were made, in only three was it elevated. In two previously reported cases and in the three cases reported in this article the blood cholesterol was within normal limits. This suggests that further studies should be made on the metabolism of other lipids as well as cholesterol. Chemical analysis of excised tumors should provide interesting data.

A curious fact volunteered by two of the patients reported herein is that the tumors were painful when they were growing but asymptomatic when full grown. Hellier[12] and Bonnefous and Valdiguie[4] reported this same phenomenon. This characteristic is worthy of note as lipomas are singularly asymptomatic.

Other conditions have been reported to occur simultaneously with familial multiple lipomatosis but they are very likely coincidental. Hanhart[11] noted the presence of palmar and plantar tylosis in the patients he observed. Bonnefous and Valdiguie[4] suggested that a neoplastic diathesis existed in one of their patients because of the presence of several different benign tumors in addition to carcinoma of the breast. Familial multiple telangiectases as well as familial multiple lipomatoses were found in the three patients whose cases are reported herein.

## CASE REPORTS

CASE 1. Mrs. D. M., a seventy-seven year old white woman (Charity Hospital), was first seen on May 19, 1950, in the surgical outpatient clinic complaining of a tumor on the back of her neck. The mass had been present for many years and was causing a mild discomfort because of its size. On both arms were many smaller masses which had made their appear-

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TABLE 1

| Author | Sex | Generation | Age | No. of Tumors | Biopsy | Cholesterol | Comment |
|---|---|---|---|---|---|---|---|
| Murchinson[19] | M | A | | Many | | | |
| | F | B | 20 | 25 | | | |
| | F | B | 16 | 29 | | | |
| Madelung[17] | M | A | | Several | | | |
| | F | A | | Several | | | |
| | M | B | 33 | Several | | | |
| Robinson[23] | M | A | | Many | | | |
| | M | B | 23 | Many | | | |
| Blaschko[3] | M | A | Puberty | Many | | | |
| | M | A | Puberty | Many | | | |
| | M | B | Puberty | Many | | | |
| Boucher de Rouen[5] | F | A | | Many | | | |
| | F | B | 55 | Many | | | |
| Alsberg[1] | 3M | A | 21 | Many | | | |
| von Benard[2] | F | A | | Many | | | |
| | M | B | | Many | | | |
| Petren[21] | F | A | 40 | Many | Yes | | |
| | M | B | 25 | Many | Yes | | |
| Ochsner[20] | F | A | | Many | | | |
| | M | B | | Many | | | |
| Serenin[24] | F | A | | Many | | | |
| | M | B | | Many | | | |
| | M | B | | Many | | | |
| Bonnefous & Valdiguie[4] | F | A | 44 | Many | Yes | 396 | |
| | F | A | 24 | Many | | 414 | |
| Leri[14] | F | A | | Many | | | |
| (2 families) | M | B | | Many | | | |
| | M | A | | Many | | | |
| | M | B | | Many | | | |
| Esquier[8] | M | A | | Many | | | |
| | M | B | | Many | Yes | | Negro (Dahomeen) |
| Wirz[25] | F | A | | Many | | | |
| Cannon[6] | M | A | | Many | | | |
| | M | B | 20 | Many | | 224 | |
| Leven[16] | M | A | 24 | Many | | | |
| | F | A | 24 | Many | | | |
| | 5M | B | 28 | Many | | | |
| Hanhart[11] | M | A | 22 | Many | | | Associated with plantar and palmar tylosis |
| | M | B | 22 | Many | | | |
| | 3M | C | 22 | Many | | | |
| Rauschkolb[22] | M | A | | Many | | | |
| | M | C | | Many | | | |
| de Leuw[15] | M | A | 21 | 2 | | | All on angles of jaw |
| (2 families) | M | A | | 2 | | | |
| | F | A | | 2 | | | |
| | F | A | | 1 | | | |
| | M | A | | 2 | | | All on angles of jaw |
| | M | C | | 2 | | | |
| Hellier[12] | M* | A | 22 | 3 | | | |
| | F* | A | 63 | 7 | | | |
| | F | B | 33 | Many | | | |
| | F | B | 40 | 1 | | | |
| | F | B | 36 | 1 | | | |
| | F | B | 31 | Many | | | |
| | F | B | 25 | 2 | | | |
| Miller[18] | F | A | 35 | Many | | | |
| | F | B | 34 | 17 | Yes | | |
| | M | B | 26 | 17 | Yes | | |
| Humphrey & Kingsley[13] | M | A | 57 | 1 | | | All appeared after the age of 40 |
| | M | A | 55 | Many | | 460 | |
| | M | A | 53 | Several | | | |
| | M | A | 52 | 1 | Yes | 217 | |
| | F | A | 49 | 1 | | | |
| | M | A | 46 | Many | | | |
| Kurzweg & Spencer | F | A | 60 | 30 | Yes | 194 | Associated with familial multiple telangiectasia |
| | F | B | 52 | 50 | Yes | 230 | |
| | F | B | 30 | 60 | Yes | 240 | |

* Man and wife.

ance some fifteen years previously, coincident with a loss of weight from 205 to 165 pounds. None of this patient's ancestors were known to have had tumors. Two of her daughters, ages fifty and fifty-three, had many lipomas but two other daughters, ages fifty-four and thirty-two, were not so afflicted. There were no sons in this family.

On the posterior and anterior surfaces of both arms and forearms there were multiple firm and soft, freely movable subcutaneous nodules varying in size from 1 to 3 cm., non-tender and smooth in outline. There was an 8 by 8 cm. soft, almost fluctuant mass on the nape of the neck. No tumors were found on the head, trunk or lower extremities. In addition, there were numerous bright red telangiectases of the skin over the trunk and extremities.

Blood cholesterol level was 194 mg. per cent. (Normal value 150 to 250 mg. per cent.)

On this same date the mass on the nape of the neck and two small ones on the left forearm were excised. They were encapsulated tumors which shelled out easily and grossly resembled typical lipomas except that the smaller ones were not lobulated. Microscopic examination revealed characteristic lipoma.

CASE II. Mrs. F. D., (daughter of D. M.) a fifty-three year old white woman (Charity Hospital), was seen on May 19, 1950, when she brought her mother to the clinic. This patient, also, had lipomas. She stated that her tumors had appeared during the previous year when her weight had decreased from 245 to 223 pounds and that the masses were painful when they were small and firm. However, later as they became larger and soft, they were asymptomatic. This patient had five daughters, ages fourteen to thirty-five, and none had tumors.

On physical examination there were many movable subcutaneous masses of two types, namely, larger soft, non-tender tumors approximately 3 to 6 cm. and smaller firm ones of 1 to 3 cm. The majority of these tumors were over the back, with a few on the arms, chest and abdomen. Also noted were telangiectases of the skin similar to those of her mother, Mrs. D. M.

Blood cholesterol was 230 mg. per cent.

On May 23, 1950, through a 3 inch transverse incision in the left lumbar area several lipomas were removed. The largest (3 by 5 cm.) was soft and lobulated; two smaller ones (1 by 2 cm.) were firm and not lobulated. These tumors were also encapsulated and easily shelled out. Through this incision were visible many lipomas varying from ½ to 2 cm. in diameter. Histologic picture was that of typical lipoma.

CASE III. Mrs. L. D., (daughter of Mrs. D. M.) a fifty year old white woman (Charity Hospital), was seen on May 23, 1950, because of numerous tumors resembling those of her mother and sister. Twenty years ago these tumors had appeared when the patient was at her maximum weight of 260 pounds; she had subsequently lost 70 pounds. These masses also were painful when they were small and asymptomatic when full grown. This patient had three sons and two daughters, ages twenty-two to thirty-one, and none had tumors.

On physical examination many movable subcutaneous tumors of two types were found, clinically identical to those of the patient's sister, Mrs. F. D. They were located mainly on the back and on the anterior surface of the thigh, with a few on the arms and abdomen. There were telangiectases scattered in the skin of the trunk and extremities.

Blood cholesterol was 240 mg. per cent.

On May 23, 1950, through a 3 inch transverse incision in the right lumbar region two lipomas were removed; one was large and soft and the other was small but firm. The larger and softer was 8 by 4 by 3 cm. and the smaller firm tumor 4 by 3 by 4 cm.

On June 6, 1950, through a 3 inch transverse incision in the left lumbar area four masses were excised. These tumors were encapsulated and easily shelled out by blunt dissection.

The microscopic picture was characteristic of lipoma.

## SUMMARY

Three cases of familial multiple lipomatosis are reported. The literature is reviewed and twenty-four families collected.

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If an incisional hernia is present lateral to the rectus abdominis muscle, it can be repaired by severing the anterior rectus sheath along the lateral border of this muscle, turning it behind the rectus muscle and then suturing it to the combined aponeurosis of the lateral abdominal muscles. Maybe 4 to 6 inches of this anterior rectus sheath are so mobilized. Above and below, the transplanted sheath is sutured to the cut borders of the normally situated anterior rectus sheath. A firm hernial repair results. (*Richard A. Leonardo, M.D.*)

# LUMBAR HERNIA*

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IN consideration of the number of potential spaces that exist in the back it is surprising that there is not a greater incidence of lumbar hernia. Actually the condition is quite infrequent, especially the spontaneous type. The hernia occurs in essentially two areas and they are so named. One hernia occurs in the inferior lumbar triangle (triangle of Petit), which is the more commonly known, and the second occurs in the superior lumbar triangle (Grynfeltt-Lesshaft space).

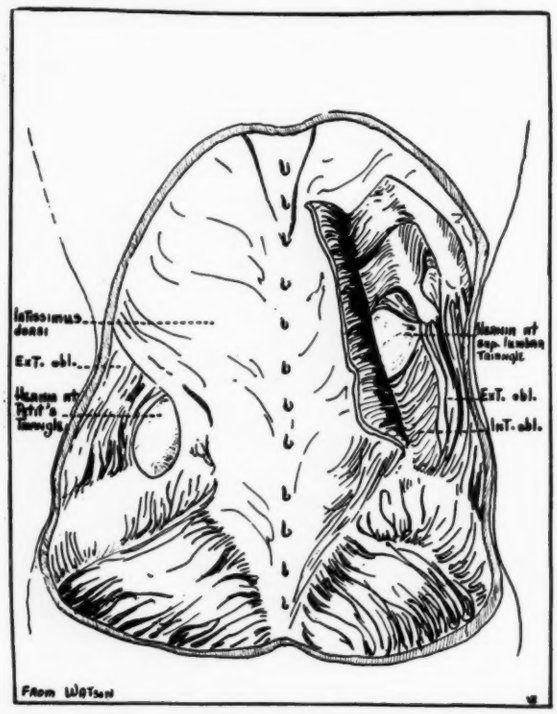


FIG. 1. Diagram of the anatomic interrelationships of hernias through the superior and inferior lumbar spaces.

Barbette discussed the possibility of the occurrence of a lumbar hernia in 1672. The first reported case was by Bridges in 1728. Petit described his first case in 1738, a patient with a strangulated hernia through the triangle which he named. In 1866 Grynfeltt clarified the problem of lumbar hernia by delineating the area of the superior lumbar triangle. Four years later Lesshaft described the same triangle without mentioning Grynfeltt. Dowd in 1907 reported the case of a three month old child with a hernia the size of a goose egg through the triangle of Petit. A nodule which could be palpated in the sac later turned out to be a suppurative appendix.

In 1923 Watson collected 115 cases from the literature, and in 1946 he gathered together a total of 146 cases of lumbar hernia of all types. Stillman reported seventy-eight cases in 1925, in eight of which (10.3 per cent) there were strangulated hernias. Kapsinow in 1943 and Stubenbord in 1944 described cases. In 1946 Flickinger and Mason reviewed seven cases from the Mayo Clinic and reported an additional one, in the sac of which kidney and bowel could be palpated.

According to Watson the condition occurs primarily in males in the ratio of 3:1, and in all ages; the majority, however, occurs in the fifty to seventy year age group. There is a predilection for occurrence on the left side in the ratio of 2:1. Less than 5 per cent were bilateral in sixty-eight cases.

The anatomic boundaries of the inferior lumbar triangle are as follows: inferiorly by the crest of the ilium, anteriorly by the external oblique muscle, and posteriorly by the latissimus dorsi muscle. The floor is covered by lumbar fascia, internal oblique and transversalis fascia. The triangle has been found to exist in the majority of cadavers examined. Lesshaft found it present in eighty-four of 108 cadavers or 77 per cent. It rarely exists in muscular individuals. The superior lumbar triangle is bounded by the twelfth rib and the serratus posticus superiorly, the erector spinae muscle posteriorly, and anteriorly by the internal oblique muscle. Its position is anterior and superior to that of Petit's triangle and probably is the cause for most of the lumbar hernias although there is some disagreement on this point. The triangle appears to exist in even a greater percentage of cadavers examined than the triangle of Petit. (Fig. 1.)

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In Grynfeltt's original description of the triangle he wrote, "The aponeurotic fibers of the transversalis, in dividing, form a passage for the lower intercostal artery, just as the spermatic enters the two pillars of the external ring. There is at this site a natural point of lessened resistance. If the lower border of the internal oblique inclines more anteriorly than normally, the last intercostal artery perforates the aponeurosis of the transversalis above the border. In other words, if the point of resistance of this artery is in the lumbocostal-abdominal triangle, all the conditions favoring a hernia are realized." Brown believed that hernias could develop at points of exit of one of the branches of cutaneous posterior lumbar nerves. Iason emphasizes the importance of the lumbar and deep circumflex arteries as they penetrate the transversalis fascia causing a potential hiatus. They may also occur through congenital openings in muscles and fascia as in the latissimus dorsi and external oblique.

Etiologically, lumbar hernia is divided into the congenital and acquired types, the former being due to faulty development of the muscles and fascia of the lateral abdominal wall. The latter may be spontaneous or traumatic. Spontaneously acquired hernias usually appear in middle or late life and are due to habitual or sudden straining such as lifting, coughing or other type of indirect injury. There is undoubtedly at this point a predisposing factor or a pre-existing defect in the area. The acquired traumatic hernia is the result of direct injury to the area, including stab wounds or postoperative incisional hernias following poor wound healing in kidney surgery. Von Baracz listed local suppuration or abscess formation as a cause in 7.6 per cent of his cases.

The symptoms of lumbar hernia are those of a bulging mass which is usually reducible. Obstructive symptoms may be present in cases in which the hernia is large and when the contents are bowel or kidney. Strangulation and incarceration in these hernias are rare, however. Diagnosis is usually simple. There is an impulse on coughing and a tympanitic note may be heard on percussion depending upon the contents of the sac. Lumbar abscesses, hematoma, fibroma, lipoma and muscular hernias must be considered in the differential diagnosis.

Treatment consists of mechanical support, injection therapy and surgical repair. Trusses may be used; but since the hernia gradually enlarges, surgical repair must eventually be performed. Injection therapy is universally unsuccessful and may be dangerous. The surgical procedure to be used in the repair depends primarily on the size of the defect. In the smaller hernias, after identification of the sac and by reducing same, the margins of the muscles may be approximated or overlapped by interrupted sutures of chromic catgut. This procedure was used by Owen (1888) who reported the first successful repair. The opening may also be closed by a purse-string suture followed with overlapping. When there is a tumor of fat in the sac, this can be ligated at the pedicle and excised.

In large hernial defects it may become necessary to detach adjacent fascia to cover the defect. Dowd in 1907 formed a flap from the aponeurosis of the gluteus maximus and medius to repair a hernia through the triangle of Petit. In 1917 Rishmiller constructed a flap from the aponeurosis of the latissimus dorsi. Flaps from fascia lata have also been used successfully, especially in a basket-weave type of flap over the defect as was used by Flickinger and Masson in their case. The latter procedure was first proposed by Kelton. Following construction of the flap additional closure and support are given by approximating the adjacent muscles where possible.

### CASE REPORT

The patient, a sixty-five year old white male, was admitted on September 16, 1947, complaining of left flank pain of three days' duration which he had noticed following the lifting of a sack of potatoes. He had had frequency, nocturia and burning on urination for two weeks.

On examination and pyelography he was found to have multiple, semi-opaque calculi in the lower pole of the left kidney and bilateral lumbar hernias. The right hernia was 9 cm. in diameter and the left, 4 cm. (Fig. 2.) Questioning revealed that the patient had had the right hernia about twenty years and the left about ten years. On a previous admission for a prostatectomy in 1936 he was found to have a hernia only on the right, which was 5 cm. in diameter. He related that neither hernia had been associated with any injury but they had developed gradually and were increasing in size slowly. However, they rarely caused him any discomfort.

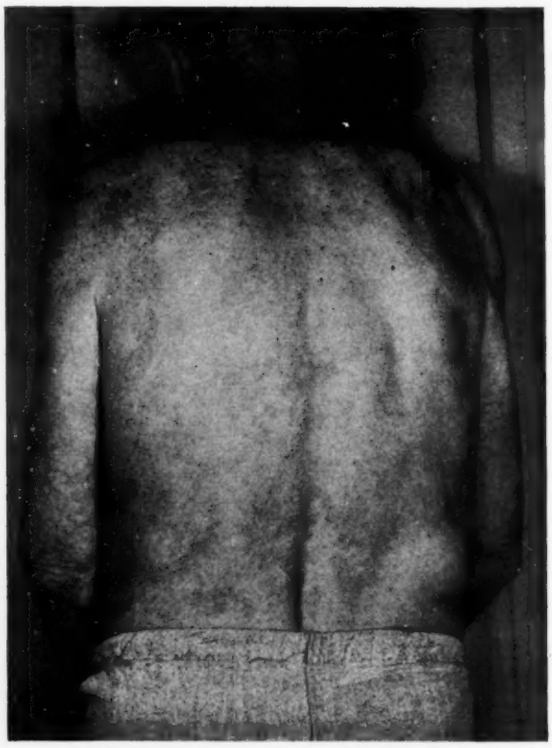

FIG. 2. Shows patient with bilateral lumbar hernia through the superior lumbar triangle.

The blood count was normal, with 14 gm. of hemoglobin; the urine showed two plus albumin, clumps of pus cells and many red blood cells. Serology was negative.

A left partial nephrectomy was undertaken through a flank incision. The hernial sac was found just beneath the skin and protruding through a defect corresponding to the Grynfeltt-Lesshaft space. However, there was in addition a defect in the fibers of the latissimus dorsi muscle. The sac was easily reducible and consisted of transversalis fascia and its retained retroperitoneal fat. The partial nephrectomy was performed without difficulty and the kidney was returned to its bed. The defect was easily closed after invaginating the sac by approximating the muscles of the serratus posticus and internal oblique with chromic catgut, then overlapping this with the latissimus dorsi muscle. After six weeks the repair appeared to be solid but, unfortunately, there was a persistent draining sinus from the kidney. Eventually nephrectomy had to be performed because of an area of necrosis in a portion of the remaining lower pole. The patient was seen in January, 1950, at which time the scar was solid and he said he intended to have the right side repaired as soon as he had more discomfort from it.

## CONCLUSION

1. The authors discuss the anatomic relationship of superior and inferior lumbar hernias, their causes and treatment. One case has been presented.

2. Lumbar hernias may be congenital or acquired although all spontaneous hernias probably have a congenital weakness in the area as a predisposing factor.

3. Cures are effected only by surgical repair using a technic of muscle approximation, fascial flaps or fascial transplants.

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# PAPILLARY CYSTADENOMA OF THE ROUND LIGAMENT IN NUCK'S CANAL*

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THE rarity of tumors in Nuck's canal, particularly the cystadenomas, prompts us to record another case in the literature. Because the pathologic disorder in our case has a possible malignant potential, we believe this to be the third case of such nature to be reported.

Masses found in the inguinal canal of females are frequent. However, when an epithelial-lined cystadenomatous mass is encountered in a fibromuscular structure such as the round ligament, an explanation is sought by the physician and pathologist.

The round ligament is a mesodermal structure formed by the caudal portion of the mesonephric fold. It begins at the cornu of the uterus and extends through the internal inguinal ring and along the inguinal canal to the labia majora. In its exit from the peritoneal cavity it may carry a sheath of peritoneum, thus creating Nuck's canal. Tumors may thus be intra- or extraperitoneal.

The round ligament is made up of smooth muscle, fibrous tissue, fat, blood and lymph vessels, and nerves. The finding of epithelial elements in these tumors suggests defects in the embryologic development with displaced ovarian or tubal epithelium.

Two hundred fourteen tumors of the round ligament were summarized by Schedorf in 1941. The following types and numbers were listed: 100 fibromyomas, twenty-two cysts, forty-two endometriomas, thirty-four adenomyomas, two lipomas, eight sarcomas, two cystadenocarcinomas, one aberrant ovarian tissue, one lithiasis, one dermoid and one capillary hemangioma.

These tumors are most commonly found in the third and fourth decades. The masses are usually symptomless and they are of one to three years' duration. They are slow growing. The endometriomas usually show definite swelling and pain associated with the menstrual period. Non-neoplastic tumors are also found. Lymphangiomas, hernias, hermaphroditism and pyocele have been reported.

Gross pathology was as follows: The mass varies in size with type of tumor. Some have been reported as weighing 488 ounces. Fibromyomas have the same appearance as those found elsewhere. Cysts may be lymphangiomatous, dermoid or hemorrhagic. Histologically there is variation of the type of tumor.

## CASE REPORT

E. R., a white female forty-five years of age, was seen on July 5, 1950. She first noticed a small lump in the right groin about one and a half years prior to examination. This lump had been associated with pain or discomfort and had grown only slightly during the previous few months. There was no history of increase or decrease of the mass relative to the menstrual cycle. Examination disclosed a round, firm, fluctuant 4 cm. sized tumor in the right inguinal region in its lower third. It was mobile and non-tender. There was no impulse on coughing or straining. Pelvic examination revealed a rather severe cervicitis which bled somewhat on manipulation. The uterus was anterior, slightly enlarged and somewhat irregular in outline. The adnexa presented no masses and no tenderness. The preoperative diagnosis was probable hydrocele of Nuck's canal. At operation a small cystic mass approximately the size of a lime was found in the right inguinal region. The inferior surface of this mass was intimately attached to the border of the abdominal ring by fine fibrous strands. The mass was freely movable and was easily dissected away from the surrounding tissue. Upon opening the mass it was found to contain approximately 10 cc. of light brown gelatinous fluid. At the inferior extremity at the lumen of the mass was a pupilliform-shaped body measuring approximately 1½ by 1 cm. The latter was dark red in color. The cervix was biopsied at four different sites and showed no evidence of malignancy. Curettage of the uterus showed highly secretory endometrium. Convalescence was normal.

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Gross pathology showed a collapsed cyst approximately 3½ cm. in diameter, the outer surface was roughened and the walls approximately 1 mm. in thickness. The inner surface was smooth and in one area there was a papillary excrescence approximately 2.2 cm. in size. It was pinkish gray in color and friable on cutting.

In the microscopic examination the papillary mass was found to be lined by variably multilayered opaque columnar epithelium. The elongated nuclei were slightly hyperchromatic. There were slight variations in size and shape and occasional mitoses. The basement membrane was intact. The fibrous tissue stroma was edematous and moderately infiltrated with lymphoid cells.

The pathologic diagnosis was papillary cystadenoma of Nuck's canal. The tumor was reported as being completely removed but appeared to have a malignant potential.

SUMMARY

A rare case of papillary cystadenoma of Nuck's canal with a malignant potential in a white female forty-five years of age is reported. This to our knowledge is the third reported case in the literature. The embryology, pathology and possible etiology are discussed.

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# PERFORATION OF THE SMALL INTESTINE FROM NON-PENETRATING ABDOMINAL TRAUMA*

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PERFORATION of the small intestine as a result of non-penetrating trauma to the abdominal wall is an unusual occurrence but one which is fraught with disaster if not diagnosed early and operated upon promptly. Bosworth[1] reviewed 1,593 cases from the literature up to 1948, with a combined mortality of 56.2 per cent and with an operative mortality of 47.5 per cent. He surveyed the records of six metropolitan and suburban hospitals of New York City over a ten- to fourteen-year period and reported that this diagnosis was made once every 10,000 to 20,000 admissions to the general surgical service, including the surgical specialties. Any type of non-penetrating trauma to the abdomen is capable of producing a perforation of the small intestine. We have recently encountered such a case which we believe should be added to the literature.

## CASE REPORT

L. W. M., a seventy-one year old white retired male, while walking through his back yard in the dark walked into an upright yard chair, injuring the lower abdomen. He soon became aware of lower abdominal pain followed in about thirty minutes with nausea and vomiting. He voided once. One of us (H. H. M.) saw him first about one and a half hours after the initial trauma. The positive findings were blood pressure 190/120, moderate cardiac enlargement, a ventral hernia involving an old suprapubic cystotomy scar and generalized abdominal distention with generalized exquisite abdominal tenderness. There was rebound tenderness with some muscular rigidity and the abdomen was entirely silent with absent peristalsis. The white blood count was 15,300. The patient was operated upon three hours following the initial trauma.

A mid-line incision was made and the old previous operative scar was excised. The abdomen was opened into what appeared to be a ventral hernia sac with a large neck. Immediately upon inspection the abdomen was found to contain a moderate amount of red blood, clots of blood and fecal material. One loop of jejunum was visualized, which seemed to have a large adherent clot. This was drawn into the wound and, when the clot was stripped away, a large perforation approximately the size of a quarter was noted. This was closed and the blood and fecal material removed as far as possible by aspiration. No further injury or perforations were found. There was an area of approximately 3 inches on each side in the long axis of the bowel that appeared to be edematous and somewhat injected. The abdomen was closed without drainage. Postoperatively the patient was treated with gastric suction, antibiotics, parenteral fluids and two transfusions. He left the hospital on the fifteenth day in good condition.

## COMMENT

Due to the rarity of this type of injury it is believed that this case, with recovery, should be added to the literature.

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# New Instruments

## A GUIDE FOR HIP NAILING*

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"SOMETIMES you hit, more frequently you miss. With practise you may reach such dexterity that you can generally hit, but it is easy to go by." Since Trendelenburg in 1878 spoke these words regarding the internal fixation of femoral neck fractures, many surgeons have attested to the truth of this statement and even the expert operator would at times have welcomed the aid of some reliable guiding device.

TABLE 1
OPERATIVE TIME AND OUTCOME OF SINGLE AND MULTIPLE INSERTIONS IN THE INTERNAL FIXATION OF FEMORAL NECK FRACTURES

| Internal Fixations of Fractures of the Femoral Neck* | No. of Cases | Average Time (min.) | No. of Undetermined | No. of Determined | Successes | Failures |
|---|---|---|---|---|---|---|
| Total | 485 | 72 | 281 | 204 | 164 | 40 |
| Single insertion | 371 | 67 | 204 | 167 | 138 | 29 |
| | 69.3% | | | | 82.6% | 17.4% |
| Multiple insertions | 114 | 87 | 77 | 37 | 26 | 11 |
| | 30.7% | | | | 70.3% | 29.7% |

* Orthopedic services of the Los Angeles County General Hospital (1942–1945); fixation devices, Smith-Petersen nail, Thompson "Z" nail, Mason nail, Neufeld nail and hip bolt.

A review of the literature reveals a variety of instruments which have been designed to facilitate the insertion of nails, screws and bolts used for the fixation of femoral neck fractures. Among the more recent contributions in this field are those of Groves,[7] Bailey,[1] Engle and May,[5] Littig,[10] Cubbins, Scuderi and Callahan,[4] Cole,[2] Geckeler and Tuttle,[6] Crecca and Cetrulo,[3] Larsen,[9] Stone[11] and Hopkins.[8] Some of these instruments aim at ascertaining direction in the anteroposterior and lateral planes with the aid of fluoroscopy or roentgenograms. Others utilize the anatomic features of the bone to establish the course to be followed by the fixation device. Some of the guides are held by the operator or by an assistant while others are attached to the bone by means of clamps or screws.

The need for a precision guide for the internal fixation of femoral neck fractures becomes more apparent when the following facts are considered: The head and neck of the femur consist largely of cancellous bone which is easily broken and crushed. The holding force of this cancellous bone is greatly diminished if the fixation device must be reinserted. Table 1 shows an analysis of 485 cases of fractures of the neck of the femur treated with internal fixation. Sixty-nine and three-tenths per cent or 371 cases are classified as single insertions. These, however, include cases in which the surgeon made no reference as to the number of insertions. In 30.7 per cent or 114 cases the surgeon reported two or more insertions. The actual percentage is probably higher since it is not uncommon for surgical reports to omit mention of alignment corrections. Although the final outcome was undetermined in a number of cases, it is significant that in those in which the end results were known there was a 12 per cent increase in failures in the group requiring reinsertions as compared with those recorded as initial insertions. The importance of single insertions is obvious.

The average time of surgery for each group is reported. Reinsertions required on the average twenty minutes longer than did single insertions. The majority of patients with fractures in this region are in the upper age bracket. Consequently, the more quickly the operation can be performed the better are the prospects of immediate recovery.

The nail guide to be described was designed to meet certain requirements as to adjustability and accuracy. Fifty hips from cadavers were used for experimentation before clinical trial was attempted.

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*Description.* The nail guide is constructed of stainless steel. (Fig. 1.) It consists of a bracket with a pair of legs which are fastened by means of two screws to the upper and lateral aspect of the femoral shaft. (Fig. 2.) Sliding on each leg is a pivot block which may be anchored at any position by a setscrew. Between the pivot blocks is a circular rod upon which a sector may both rotate and slide. The sector may be fixed in any position along this rod by adjusting the setscrew in the sector block. Pivoted at the center point of the sector and moving around its periphery is the body, a rectangular tube, with a block mounted on the upper surface. By means of a setscrew in this body block the body may be fixed in any desired angle around the periphery of the sector which is calibrated to ascertain the degree of rotation. Attached to the body are two guide arms. The anterior or upper arm can be aligned in the anteroposterior plane while the lateral or lower arm can be adjusted in the lateral plane of the neck and head of the femur. The long axis of the tubular body always coincides with the line of intersection of these two planes. In Figure 4B the guide wire is seen bisecting the holes in the guide arms and illustrating the precision with which the fixation device will follow the course indicated by the anterior and lateral arms.

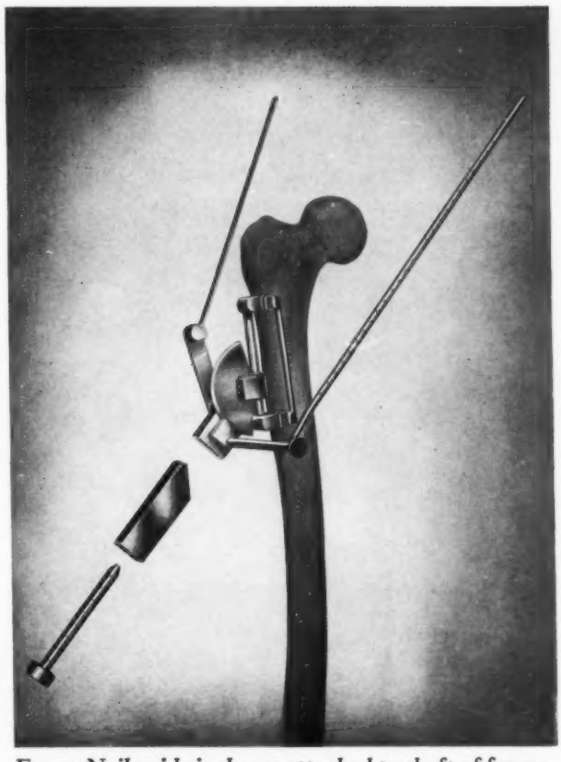
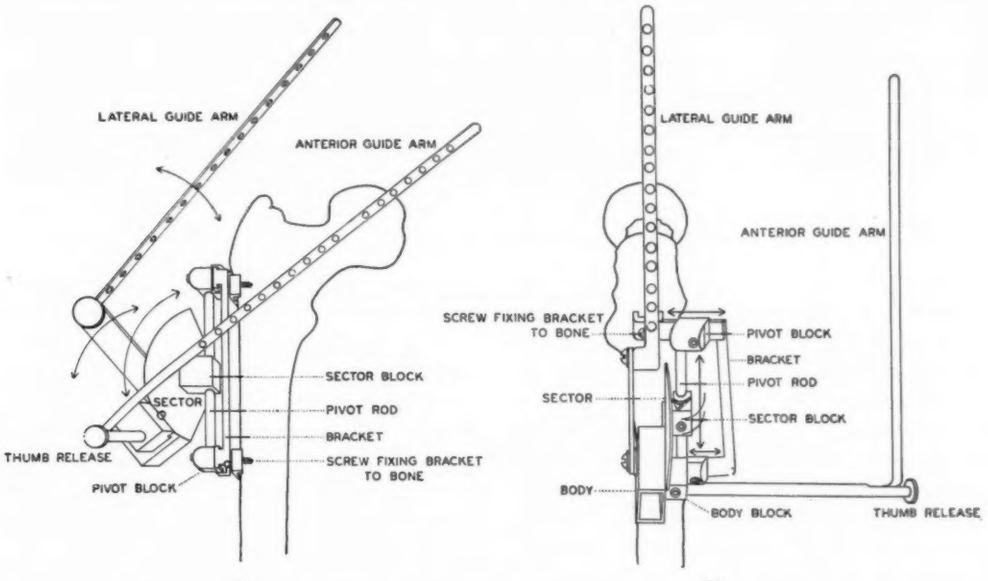


FIG. 1. Nail guide is shown attached to shaft of femur.




2A 2B

FIG. 2. A, Anterior view of nail guide; the anterior guide arm is located in front of the thigh in the anteroposterior plane of the femoral neck and head. B, lateral view of nail guide; the lateral arm is adjusted in the lateral plane of the neck and head of the femur.

*Procedure.* Because of the 13 degree anterior angulation of the neck of the femur the thigh is rotated until the patella is directed forward and 20 degrees medialward. This brings the neck and upper shaft of the femur

into the same horizontal plane. (Fig. 3, Step 1.) The lateral aspect of the shaft of the femur below the greater trochanter is then exposed and the vastus lateralis turned back to its tendinous origin from the linea aspera. (Fig. 3, Step 2.) The clasps attached to the ends of the legs of the guide are placed as close to the linea aspera as possible and the legs fastened to the lateral cortex of the shaft by two short screws. (Fig. 3, Step 3.)

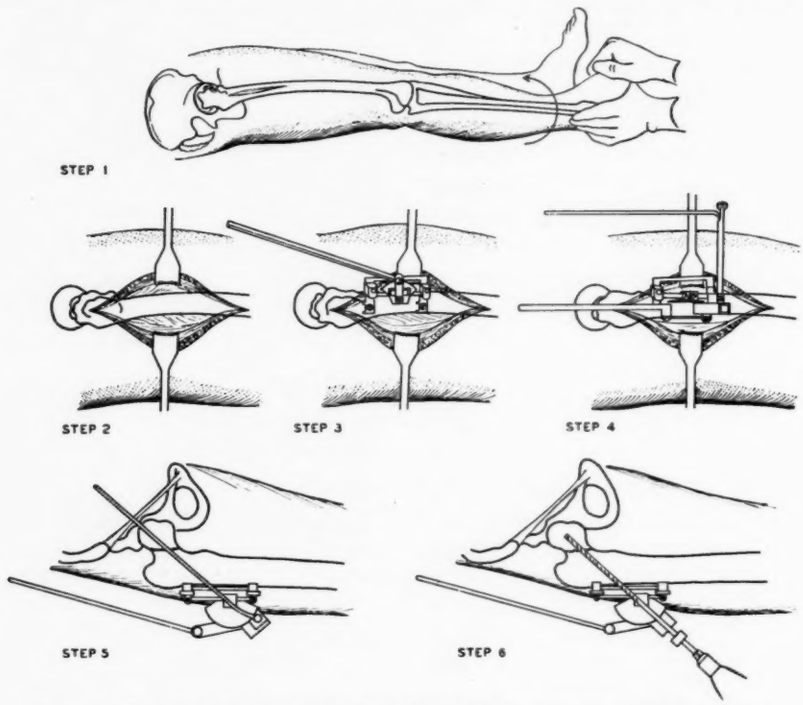
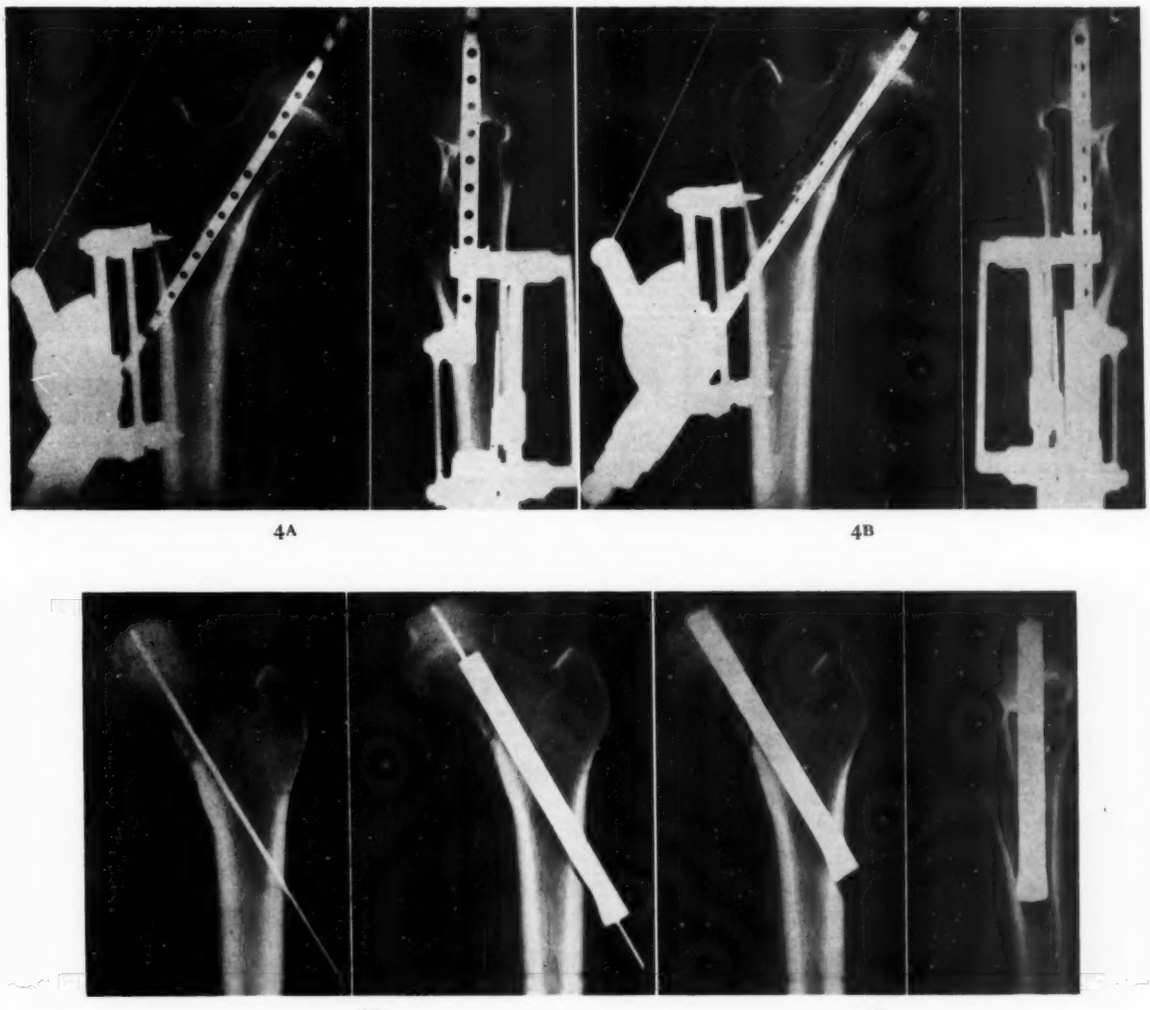



FIG. 3. Main steps in use of nail guide; the four setscrews used to make adjustments are operated by an Allen wrench. Step 1: Rotate thigh medialward. Step 2: Expose lateral shaft of femur. Step 3: Fix guide to bone with two screws. Step 4: Place lateral guide arm horizontally along mid-plane of neck. Step 5: Adjust anterior arm in desired anteroposterior plane. Step 6: Drill hole to required depth and insert fixation appliance.

The customary landmarks are used in aligning the anterior and lateral guide arms. The neck of the femur is presumed to lie in the horizontal plane, and the lateral arm is therefore fixed horizontally along the middle of the lateral aspect of the greater trochanter. (Fig. 3, Step 4.) The anterior arm is now slipped into the body block and directed over the anterior aspect of the thigh (neck and head of the femur). If the axis of the neck is to be followed, the mid-point between the anterosuperior iliac spine and the pubic tubercle is chosen. If more vertical fixation is desired, a point approximating the lateral one-third and medial two-thirds of the inguinal ligament is selected. The anterior arm is then adjusted to follow the desired anteroposterior plane. (Fig. 3, Step 5.)

If reduction is already complete, anteroposterior and lateral roentgenograms are made. If the fracture is yet to be reduced, the anterior guide arm is removed by means of the thumb release, the lateral guide arm is swung away from the lateral aspect of the thigh and any manipulative measure freely performed without interference from the guide. Before roentgenograms are taken to check reduction the lateral guide arm is swung back into position and the anterior guide arm slipped into the body block. The original alignments are thus re-established.

The roentgenograms made to determine accuracy of reduction will also indicate the relation of the guide arms to the bone. Any adjustments necessary to procure exact positioning of the guide arms (to the bone) are now possible without difficulty. If necessary, the angulation of the anterior arm may be improved by loosening the setscrew in the body block and rotating the body about the



4A 4B

4C 4D

FIG. 4. A, Guide used for inserting a Smith-Petersen nail; anterior and lateral guide arms are superimposed on bones. B, guide wire seen precisely following direction of arms. C, the guide has been removed and a cannulated nail inserted. D, anterior and lateral views of the well positioned nail.

sector. Any adjustment in the frontal (superoinferior) plane may be made by loosening the sector screw and moving the sector block (with the sector, body and anterior arm) the required distance up or down the pivot rod. The exact position in the lateral plane is obtained by appropriately adjusting the lateral guide arm. This is done by moving one or the other pivot up or down the corresponding leg or by rotating the sector about the pivot rod. If reduction was satisfactory and only minor adjustments were made in the initial alignments of the guide, additional roentgenograms are unnecessary.

When the roentgenograms indicate correct alignment of the arms, the surgeon is ready to insert the fixation appliance. By noting the number of holes of the anterior arm superimposed on the film the operator can determine the precise length in centimeters of the fixation device. The guide is designed for use with a variety of fixation appliances. The appropriate adapters are slipped into the rectangular body for the directing of the desired drills, wires or fixation devices. Figure 4 illustrates the insertion of a Smith-Petersen nail by means of the guide.

## COMMENTS

Most of the guides previously devised require accurate determination of the site of entry for the fixation device before the guide is

applied to the bone. Since this is difficult, time-consuming and not always practical, less desirable placements are sometimes accepted. In general, guides establish accurate alignment in the anteroposterior plane but do not provide for measured adjustment in the lateral plane. Some guides are not rigidly fixed to the bone. This is a disadvantage for movements of the guide relative to the bone may occur thus negating time and effort already expended.

The nail guide is a precision instrument; and if reasonable care is exercised in directing the roentgenograms, precise fixation in any desired position is assured. In taking the anteroposterior film the tube should be centered over the neck of the femur so that the tube, guide arm and neck lie in the same vertical plane. This is simple if the surgeon sights along the vertical and horizontal segments of the anterior arm. The holes in the anterior guide arm are so calibrated that when the tube is placed 24 inches from the femur the number of holes superimposed on the film indicate the exact number of centimeters of actual measurement. Any standard procedure may be used in taking the lateral. The writer prefers the lateral film to be shot from the opposite side of the table, the casette being held against the lateral aspect of the thigh. The unaffected limb is draped and raised out of the way when necessary. It is desirable to use a yardstick when taking the lateral film to make certain that the tube is the same height from the floor as the neck of the femur.

Appropriate preparation for taking the roentgenograms is desirable. The following procedure has proved helpful: The anteroposterior film is taken first, then the lateral. The x-ray unit is left in this position while the films are developed. If after adjustment of the guide additional roentgenograms are desired, the lateral view is taken first, thus saving valuable time. The use of two x-ray units, when available, will still further save time. In a moderately equipped surgical set-up approximately forty to fifty minutes in all will be required for the average insertion of a fixation appliance. The steps involved in hip fixation using the nail guide are as follows: (1) making of incision, attaching guide to femur and aligning guide arms; (2) reducing of fracture,* roentgenograms taken to check reduction and alignment of guide arms; (3) adjusting guide arms to the precise position desired for nail placement, roentgenograms† taken to recheck alignment of guide arms; (4) drilling of hole or guide wire for direction of fixation appliance and (5) removal of guide and placing of fixation device. The guide has been found highly satisfactory on clinical trial.

* This time saved if fracture previously reduced.


## SUMMARY

A precision nail guide giving three-dimensional direction has been described and the procedure for its use presented. The guide has certain advantages. It is simple and easy to use, decreases average operative time, gives anteroposterior and lateral alignment, measures accurately the length of the fixation appliance required, assures exact placement in any desired position on first insertion, requires fewer roentgenograms, acts as a retractor for tissues in anterior portion of operative field and is adaptable to a variety of fixation devices, as the Smith-Petersen nail, Moore pins, Thompson "Z" nail, lag-screw of Lorenzo and hip bolt.


*Acknowledgment:* Appreciation is expressed to Dr. G. Mosser Taylor on whose service at the Los Angeles County General Hospital the clinical trial of the nail guide was made.

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† If only minor adjustments made in guide arms, recheck films are unnecessary, thus reducing operative time.

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McVay et al. have recently shown that Trichomonas vaginalis vaginitis can be readily cured by aureomycin introduced into the vagina by insufflation or by means of vaginal suppositories. Orally, this antibiotic is of little or no value. Insufflation is done several times for the first week and 500 mg. of aureomycin are used, in 2 gm. of powdered talc, at each sitting. Thereafter vaginal suppositories containing 250 mg. of aureomycin suffice. The patient inserts one nightly for two weeks. Most patients are readily cured but recurrence or a new infection with trichomonas may develop in some after a few months. Pregnant women with this disease were also greatly benefited by the intravaginal use of aureomycin. Sexual intercourse is to be avoided during course of treatment and douches should be avoided during the period of insufflation therapy. Douches twice a week are allowable thereafter. (*Richard A. Leonardo, M.D.*)

# A TEMPORARY PROSTHESIS FOR AMPUTATIONS OF THE LOWER EXTREMITY*

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IN an effort to enable the amputee to walk early and quite normally with a temporary prosthesis the Orthopaedic Service and the Chief of Corrective Therapy of this hospital have developed the simple apparatus herein described.

Every general hospital usually has a splint morgue and it was from this source that we salvaged the discarded ischial height or weight-bearing straight leg caliper braces which constitute the important skeleton framework of this prosthesis. A brace must be located that can be lengthened or shortened as desired. The side irons must be contoured to meet that of the stump and thigh.

From a piece of pine 2 by 4 inches a block-like foot is fashioned by means of a drawknife and plane so that it will follow the contour of the sole, the size and shape of the patient's shoe. (Fig. 1.) This foot piece should fit well against the heel but extend no farther forward than the part at which the metatarsophalangeal articulation would rest. Thereby when a forward step is taken, the shoe will break at the toe and assume a somewhat normal ankle-toe-bending gait. Also the wooden foot gives a solid weight-bearing stability to the heel and sole of the shoe.

From another 2 by 4 piece of pine, 8 or 10 inches long, a leg is similarly carved. The lower end is so angled that when fixed by four inch screws or glued with four ¼ inch wooden dowel pegs to the wooden foot piece, it will assume a position of about a 10 degree plantar flexion (equinus) to compensate for the height of the shoe's heel. (Fig. 1.)

A posterior leather strap is looped around the side irons and fixed to the upper portion of the posterior part of the wooden prosthesis. (Fig. 2A.) Its length should be sufficient to limit the amount of dorsiflexion of the foot to about 5 degrees. A loop of rather heavy rubber tubing is fixed from the strap around the front of the prosthesis to act as a spring to bring the foot back to the 5 degree dorsiflexion position after the heel has been placed on the floor in the forward step. (Fig. 2B.) This also prevents the toes from dragging after the step is completed, giving a simulated range of ankle movement during a complete walking step.

If the brace has a long dorsally laced thigh cuff, such may prove appropriate provided it can be fitted to cover the stump. (Fig. 3.) However, should it not be of sufficient length, it may be replaced by a new well fitting long leather cuff which is then riveted to the brace. Further, the cuff must be split longitudinally behind and have lacing to maintain tight contact on the stump as it shrinks. (Fig. 4.)

Lastly, a 2½ inch wide heavy leather belt is worn around the patient's belt line. To this is attached from the lateral portion of the ischial ring a strap to give stability to the prosthesis. (Figs. 3A and 3B.) Additional straps from the ring to this belt may be added as needed in the front or back to correct the stump walking posture. A brace with a hip hinge above the lateral side iron to which the strap from the belt may be attached is even more comfortable for the patient.

This type of apparatus is adaptable to all amputations of the lower extremity above the junction of the middle and upper third of the leg.

For walking a straight leg splint is necessary but one with a lock-knee joint is very desirable as it enables the patient to release the lock and sit quite normally.

For amputations below the knee a below-knee cuff is essential to maintain extension of the stump when walking.

It is absolutely essential that the metal tube assembly in the heel which holds the side iron lugs be strongly secured to the shoe as the stress and strain on the heel of the shoe when walking is great. In certain cases we have found it desirable to affix the wooden foot to the sole of the shoe with screws. However, when this is not necessary, the patient can remove the shoe from the wooden foot and wear matching socks.

* From the Orthopaedic Service, U. S. Veterans Hospital, Lincoln, Neb.

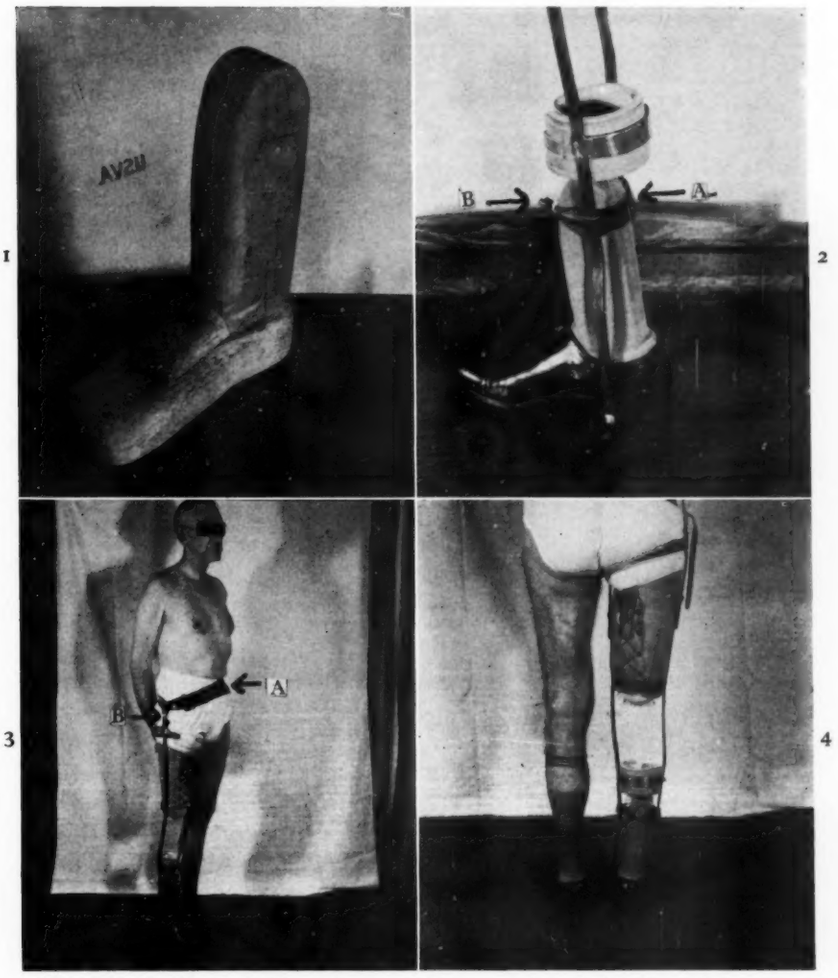


FIG. 1. Wooden foot and leg piece securely screwed and glued together.
FIG. 2. Wooden foot with sock and shoe. A, posterior strap from side irons is secured to the leg by a screw to prevent dorsiflexion of more than 5 degrees; B, rubber tube fastened in front to give spring to foot movement when walking and prevent toe drop.
FIG. 3. The prosthesis complete with well fitting dorsal laced thigh cuff the length of the stump. A, the belt and supporting strap from lateral part of B, ischial ring.
FIG. 4. The prosthesis from behind showing posterior lacing of the stump cuff.

The advantages of this inexpensive temporary prosthesis, after experience with its use in six cases, are as follows: (1) It can be applied early after wound healing. (2) Shrinkage of the stump is accomplished not only by the bandaging but also by the pressure of the fore and aft lacing of the cuff. (3) Muscle tone and circulatory stimulation are encouraged by exercise and early ambulation. (4) Although the patient walks with a stiff knee, the ankle movement gives sufficient elasticity for him to assume a remarkably normal gait. (5) With his trousers and shoe the prosthesis is well hidden and the patient gains self-confidence as he moves freely around. (6) He can be discharged from the hospital early and with frequent check-ups he can accomplish a considerable amount of his rehabilitation at home. (7) When he obtains his permanent prosthesis, it is but a matter of his having a few hours of gait training as he already has mastered locomotion and established equilibrium with his temporary prosthesis.

The second author of this contribution is responsible for the idea of this prosthesis and with the cooperation of the Orthopaedic Service it has become a very valuable and practical appliance.

# ATRAUMATIC MULTI-PURPOSE OBSTETRIC FORCEPS*

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THE influence of forceps marks on children is frequently discussed in the medical literature. In some cases the child is born with readily discernible abrasions and contusions (due to forceps blades) which disappear within the first week after birth. In other cases those marks constitute permanent scars. Occasionally a child is born with forceps marks and severe intracranial damage (due to forceps trauma) that is incompatible with the development and function of some of the child's faculties. In an indeterminate number of cases the damage done by forceps manifests itself remotely years later in epileptiform convulsions, mental retardation or weakness of isolated muscular units of the body. These are some of the results caused by the use of forceps even when applied by competent obstetricians. However, the use of obstetric forceps is frequently necessary and often life-saving to both mother and child.

The injuries caused by forceps, correctly applied, have in general a bipartite distribution, namely, too much pressure applied through the forceps over soft, yielding areas and/or slipping of the tightly closed forceps upon the child's head.

The work to be described is the result of a new and uniform treatment of any of the standard obstetric forceps. This work was first conceived by the author in June, 1947, and by the end of November, 1948, preliminary successful testing of this kind of forceps had already been accomplished on the obstetric service of Beth Israel Hospital.

Treatment of the forceps was designed to decrease the tendency of the forceps to slip, to cushion the effect of the force transmitted through the forceps to the child's head, to provide a softer, less abrasive surface with which the fetal head is in intimate contact and to increase the range of application of the average obstetric forceps in re-rotation and traction effect.

## SPECIFICATIONS FOR FORCEPS PROTECTION

The following are the original specifications for this forceps coating and these specifications are still maintained in the final instruments now in active use: (1) The coating material can withstand a maximum pressure of 10 pounds per square inch without adversely affecting the material. (2) The material can be boiled in water at 212°F. or autoclaved at 250°F. and 26 pounds per square inch of pressure for more than fifty hours without shrinking or losing any qualities. (3) It cannot be changed in any way by repeated brief contacts with blood, mucus, alcohol, mercurochrome, merthiolate, Scott's solution, lysol, phenol, urine, amniotic fluid and feces. (4) The material has a smooth, moderately soft, spongy character with little or no tendency to slip. (5) The coating has a combined thickness on both forceps blades of not more than $\frac{1}{20}$ of an inch (the thickness of the average forceps blade ranges from $\frac{1}{8}$ to $\frac{1}{12}$ of an inch). (6) The application of the coating to the forceps is uniform and coherent and, regardless of the abrasive force applied to the coating, there is no tendency for any but possibly microscopic particles to be rubbed off.

Simpson and Tucker-McLean forceps obtained from the Department of Obstetrics and Gynecology of Beth Israel Hospital in New York City were used as the original models. The fetal surfaces of these blades were uniformly coated with a special coating to a total thickness of approximately $\frac{1}{20}$ of an inch. The coating extends down the fetal surfaces of the blades to approximately $3\frac{3}{4}$ inches above the lock, at which point the coating ends evenly and abruptly. (Fig. 1.) This coating is further continued in its application over the fetal surface of the blades on to the narrow area between the fetal and maternal surfaces of both blades and also around the inner aspect of the fenestration in a fenestrated blade up to but in no way including the maternal surface of either

* From the Department of Obstetrics and Gynecology, Beth Israel Hospital, New York, N. Y.

forceps blade. The forceps have been coated or protected equally successfully with both a special latex and/or a special plastic coating.

### TRIALS WITH A COATED OBSTETRIC FORCEPS

The coated obstetric forceps have been used at Beth Israel Hospital in fifty unselected cases up to the present time.* The cases in which these protected forceps have been applied were drawn from private and ward sources. The types of forceps extractions done were twenty-eight low forceps, twenty-one low mid-forceps and one mid-forceps. There were ten rotations done, using two forceps blades. Eight of these rotations were from a transverse to an anterior position and two were rotations from an occiput posterior to an occiput anterior. In addition, a single blade rotation using only one forceps blade of this coated forceps as a mechanical arm was attempted three times. Each single blade rotation was from an occiput transverse to an occiput anterior and each rotation was pronounced satisfactory. The number of times this forceps was reapplied in any individual case ranged from one to three reapplications with considerable ease in the majority of cases in sliding the forceps back and forth over the head. In sixteen of our fifty cases one or more reapplications of this forceps was done. There were two cases of known incorrect application of these forceps at the time of application with little or no subsequent manifest trauma to the child. There was one instance of moderate difficulty encountered in applying these forceps. This occurred in an isolated case of gynecoid pelvis with moderately contracted outlet. Four cases in the early part of our series met with some difficulty in correcting the application of these forceps. Since that time we have carried out the routine of wetting and/or soaping the blades just before the application and by these means have apparently obviated any slight technical difficulty in correcting the application of these special forceps. There has been no difficulty at any time in disengaging the coated forceps blades.

The effect of these forceps on the child in the various forceps maneuvers mentioned before was analyzed by different and impartial observers in terms of the child's general condition at birth, twelve and twenty-four hours later.

*Our original series has been extended, since the acceptance of this paper, to more than 300 cases with identically successful clinical results.

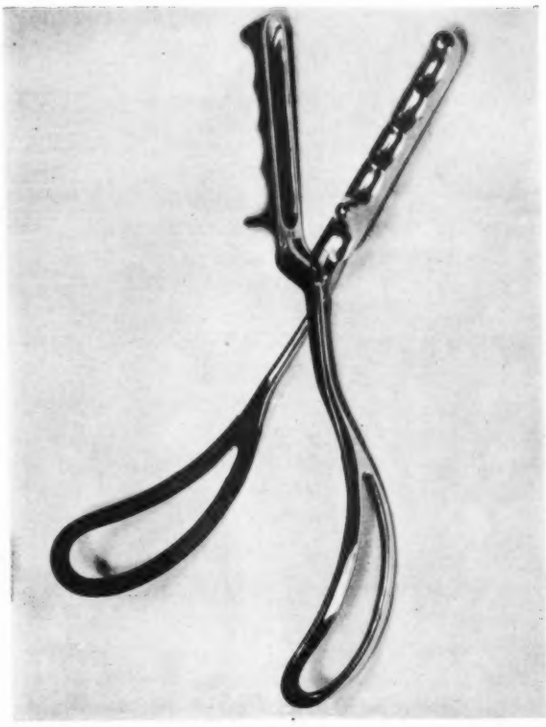

FIG. 1. Atraumatic multi-purpose obstetric forceps.

The results have been highly convincing in the series under study. Forty-nine of the fifty children born with this forceps were described as in excellent condition at birth. The fiftieth child was a difficult mid-forceps done in a contracted pelvis with immediate evidence of intracranial damage at birth. It is interesting to note that despite the inordinate traction applied in this case, the long duration of the applied force and the reapplication of the blades, there was no evidence of any forceps mark.

There was no evidence of forceps trauma (marks) at birth in thirty-nine of the fifty children delivered with these coated forceps. Ten children presented areas of hyperemia 1 to 2 cm. in length or width at the point of application of the blades. Nine of these ten areas of hyperemia were unilateral and all were described as mild. There was only one incident of trauma exceeding slight hyperemia following the use of these forceps. This was a small hematoma 2 cm. by 2 cm. in the right parotid area. This small hematoma began to fade at twelve hours and had disappeared by twenty-four hours. At the end of the twelve-hour observation period there were seven children who still had 1 to 2 cm. areas of attenuated hyperemia. The twenty-four hour examination re-

vealed only one child with trauma described as faint erythema. This was no longer evident at thirty-six hours.

There was absolutely no tendency for these coated blades to slip in any of the fifty trials conducted. The traction offered by these coated forceps was unanimously described as far better than the traction effect obtained with any of the commonly used forceps.

The coated forceps were used by eighteen different obstetricians. Their capabilities ranged from the interne level (five internes) to resident obstetricians (two) to attending obstetricians (eleven). The judgment of presence or absence of forceps marks was made by the delivery floor nursing staff, attending obstetricians, interne obstetrical staff and nursery nurses.

## SUMMARY AND CONCLUSIONS

1. A specially coated or protected forceps has been presented.

2. Obstetric forceps protected by this coating have no tendency to slip regardless of rotation factors, moulding of head, severity of forceps pull or station of vertex at time of application of forceps.

3. The traction effect observed with the coated forceps was definitely far superior to the traction secured with any other uncoated forceps *per se*.

4. The coated obstetric forceps are far less traumatic to the child's head than any non-coated obstetric forceps in use at this time. In our series of fifty cases there was only one instance of visible trauma, due to the forceps, evident at twenty-four hours after birth; this was described as faint hyperemia.

5. The rotation of a vertex from a transverse to an anterior position by means of the coated forceps was far simpler than the same maneuver with any similar uncoated forceps. The range of application of the Tucker-McLean, Simpson and similar obstetric forceps, when coated with this material, may well be extended into the field of easy single and double blade rotation.

6. This coating may be easily and quickly applied by a special process to any obstetric forceps now in use.

*Acknowledgment:* The author wishes to convey his gratitude to the Obstetric and Gynecology Staff of Beth Israel Hospital, New York City, Dr. Henry C. Falk, Director, to the B. F. Goodrich Co., Akron, Ohio, and to the Edward Weck Co., Brooklyn, N. Y. Coated, protected obstetric forceps are now being manufactured by the Edward Weck Co.

# AUTHOR INDEX TO VOLUME LXXXII


Acker, E., 697
Adams, R. W., 219
Albright, H. L., 674
Amoroso, M. D., 720
Ancona, V. C., 287
Angelo, G., 616
Auerbach, H., 498
Austin, R. C., 466

Bacon, H. C., 709
Bailey, H. A., 328
Barnes, T. C., 720
Behrend, A., 303
Bellas, J. E., 273
Berne, C. J., 5
Birnberg, C. H., 280
Blackwell, C. C., 439
Bodkin, L. G., 557
Bookrajian, E. N., 432
Bowden, L., 299
Brown, C. H., 191
Buie, L. A., 546
Burke, R. M., 659
Burns, F. J., 538
Burt, C. A. V., 571
Butler, D. B., 163

Campbell, M., 8
Cantor, M. O., 230, 697
Carlson, B., 733
Carswell, J., Jr., 402
Case, T. C., 749
Casella, P. A., 741
Cattell, R. B., 578
Chamberlain, B. E., 462
Christhilf, S. M., Jr., 251
Cipolla, A. F., 741
Cirillo, A. A., 334
Clayton, S. C. E., 55
Cliffton, E. E., 185
Cohn, I., 18
Coley, B. L., 27
Coller, F. A., 132
Collins, D. C., 689
Colonna, P. C., 44
Conroy, C. F., 293
Cooper, W. L., 546
Corff, M., 683
Coyle, E. B., 372
Crile, G., Jr., 191
Crohn, N. N., 283

Dabbs, C. H., 275
Damstra, E. F., 466
Delmonico, J. E., Jr., 462
Donnelly, J. P., 354

Eckerle, W. J., 651
Edwards, M., 533
Evans, O. T., 645
Ewell, G. H., 597

Ferguson, J. A., 553
Fernicola, A. R., 152
Fett, H. C., 55, 517
Fisher, B., 202, 288
Fisher, E. R., 202
Foregger, R., 306
Foster, K., 697
Fox, P. F., 511
Fox, R. T., 402
Freedlander, S. O., 349
Freedman, M. A., 5
Freund, H. R., 703
Freund, N. L., 564

Gann, M. E., 405
Garland, J. G., 209
Gerber, A. B., 339
Gerbode, F., 58
Goetsch, E., 71
Goldberg, S. L., 339
Goldin, M., 498
Gordon, C. A., 76, 263, 485
Gorrell, R., 413
Grant, R. N., 299
Gregg, R. O., 462
Gross, J. M., 564
Grout, J., 733
Guthrie, D., 81

Hardinge, M. G., 772
Herrell, W. E., 638
Higinbotham, N. L., 27
Hirschman, L. J., 83
Hoffman, E., 405
Holman, E., 58
Hunt, C. J., 86
Hyman, L. J., 349

Israel, G. I., 657
Ivory, H. S., 256

Jackson, A. S., 93
Jenney, J. A., 396

Kahn, J. W., 260
Karabin, J. E., 531
Karasic, J., 720
Karras, J. D., 616
Kaump, D. H., 659
Kazmierski, R. H., 248
Kelly, C. M., 533
Kennedy, C. S., 230
Kern, H. M., 479
Kesseler, P. J., 504
Khedroo, L. G., 741
Kirtland, H. B., Jr., 451
Knoepp, L. F., 213
Kobak, M. W., 283
Kohn, A., 280
Koontz, A. R., 474
Kraft, J., 86
Kramolowsky, H. H., 538
Kratzer, G. L., 560
Kretschmer, H. L., 198
Krida, A., 98
Krohn, S., 275
Kurzweg, F. T., 762

Lam, C. R., 727
Larson, E. E., 103
Lattuada, H. P., 236
Lawrence, W., Jr., 169
Lee, H. C., 290
Lemmon, W. T., 754
Lenson, N., 325
Leonard, F. C., 674
Lev, M., 339
Loch, W. E., 169
Lubin, S., 227
Luther, C., 432

Mace, A. J., 578
MacGregor, A. S., 365
Macumber, H. H., 771
Maddock, W. G., 510
Maes, U., 107, 458
Mandy, A. J., 251
Mandy, T. E., 251
Marrangoni, A. G., 378
Matas, R., 111
Mayo, H. W., Jr., 522
McClenahan, J. E., 288
McClure, R. D., 122
McDonald, J. R., 546
McMillan, F. L., 759
Mervine, T. B., 754
Meyerding, H. W., 411
Michels, A. G., 191
Moore, S. W., 390
Moosman, D. A., 132
Murray, G., 144

Nicholas, E., 733
Norment, W. B., 240
Novak, E., 149

O'Crowley, C. R., 152
O'Leary, J. L., 263, 485
O'Sullivan, W., 295

Pack, G. T., 416
Parker, M. S., 236
Phaneuf, L. E., 156
Pool, C. C., 55
Priestley, J. T., 163

Ralston, E. L., 44
Rashbaum, M., 360
Ratzan, W. J., 780
Rawls, W. B., 287
Rebbeck, E. W., 736
Reynolds, R. P., 230
Rinzler, H., 256
River, L., 733
Romieu, C., 27
Rosenthal, A. H., 263, 485

Sanders, R. L., 167
Sawyer, K. C., 746
Sayet, M. M., 769
Schairer, A., 733
Scharf, A., 697
Scheibe, J. R., 759
Senger, F. L., 766
Shelby, R. D., 771
Siegel, I. A., 251
Silverstein, J., 733
Siris, J. H., 260
Skir, I., 564
Smith, D. W., 344
Smith, N. D., 583
Sniderman, B. F., 611
Soresi, A. L., 671
Speare, G. S., 631
Spencer, R., 762
Spriggs, J. B., 275
Stalker, L. K., 381
Stein, H. D., 303
Stephens, L. J., 538
Strully, K. J., 412
Swenson, P. C., 587
Swinton, N. W., 603
Szilagyi, D. E., 122

Taniguchi, T., 293
Tanoue, R., 733
Tavenner, M. C., 709
Tedesco, V. E., 526
Thomley, M. W., 766
Thomson, J. E. M., 778
Thrush, L. B., 328
Tope, J., 733
Tucker, V. C., 626
Turner, S. J., 498
Uhrich, G. I., 533
Usher, F. C., 408

Vieta, J. O., 416

Wacker, M. N., 498
Wallace, M., 448
Walther, C. D., 381
Waltman, R., 227
Ward, G. E., 169
Warren, K. W., 372
Weisman, A. I., 278
Weiss, G. N., 458
Wesson, M. B., 714
Wexler, D. J., 280
Wickman, W., 769
Wigh, R., 587
Willis, D. A., 508
Woolsey, J. H., 179

Yeomans, F. C., 542
Yost, J. G., 517
Young, L. E., 185

Zangara, H., 533
Zavela, D., 659
Zimmer, H., 778

# SUBJECT INDEX TO VOLUME LXXXII

(E.) = Editorial


Abortions, septic, Knott technic in, 736
Abrasions, experimental, in healing studies, 720
Adenocarcinoma of gallbladder, 248
Adenoma
  of rectum and sigmoid, 546
  parathyroid, 439
Agenesis of vermiform appendix, 689
Amino acids for pruritus ani, 557
Amputation
  in aged, 479
  of lower extremity, 778
Anal gland, significance of, 659
Analgesia, postoperative anorectal, 273
Anastomosis, intestinal, and gelfoam, 462
Anatomy of splenic vein, 339
Anesthesia, wartime, 306
Aneurysm, dissecting, 522
Ankle joint, operative approaches to, 44
Anorectum
  fistula of, 83
  malignant melanoma of, 709
Antibiotics
  consideration of, 638
  in sinus and mastoid infections, 334
Anus, congenital anomalies of, in infants, 651
Appendix, vermiform, agenesis of, 689
Arteries, role of, in hemorrhoids, 626
Avulsion, traumatic, of tendon of biceps brachii, 290

Bacitracin suppositories, effect of, on vaginal flora, 498
Bandage, compressive, in venous insufficiency in extremities, 504
Barium enema in disease of colon, 553
Biceps brachii, avulsion of tendon of, 290
Bile ducts, prevention of trauma to, 132
Biliary
  ducts, repair of (E.), 671
  tract surgery, 458
Biopsy
  of breast, 741
  pancreatic, 451
Blood vessel bank (E.), 671
Bone
  skid for hip and shoulder, 411
  transplants, homogenous, 378
  tumors of, 27
Bowel
  obstruction simulated by dissecting aneurysm, 522
  resection of, with hysterectomy, 578
    with oophorectomy, 571
Bowel wall, effect of decompression tube on, 697
Breast
  biopsies, 741
  carcinoma of, 185, 733
  male, carcinoma of, 86
    enlargement of, 325
Buerger's disease, kutapressin in, 448

Calcification, intramural, of gallbladder, 248
Cancer
  female genital, and hormones, 149
  genitourinary, treatment of, 645
Carcinoma
  of breast, 185, 733
  of colon, 287
    effects of delay in, 167
  of external auditory canal and middle ear, 167
  of male breast, 86
  of thyroid, 202
  subtotal gastrectomy for, 5
Cardiac arrest, 256
  during surgery, 683
Cesarean section, 263
Chemotherapy in sinus and mastoid infections, 334
Cholangiojejunostomy, intrahepatic, 746
Cholecystitis, acute, 328, 703
Clinical diagnosis, 107
Coccygectomy and herniation of rectum, 288
Colon
  carcinoma of, 167, 287
  disease of, 553
  foreign body in, 657
  sequestrated transverse, expulsion per anum, 299
Colporrhaphy for uterine prolapse, 156
Cyst
  in ligamentum teres of liver, 531
  of neck, 93
Cystadenoma, papillary, 769
Cystitis glandularis and follicularis, 198
Cystohepatic angle, structures of, 132

Débridement, 179
Discharge from nipple, 209
Diverticula, sigmoid, perforation of, 349
Diverticulitis, 583
  coli, 674
  roentgenologic aspects of, 587
  surgical aspects of, 603

Diverticulosis, 583
Diverticulum, urethral, in women, 360
Duodenostomy, 163

Ear, carcinoma of, 167
Electrical wound potential of experimental abrasions, 720
Episiotomy repair, 251
Excision for hepatoma, 295
Expulsion per anum of transverse colon, 299
Extremities
  lower, amputation of, 479, 778
    venous insufficiency in, 504

Fascia lata repair of hernias, 466
Fibromyopathies, neurogenic ossifying, 517
Fistula
  anorectal, diagnosis of, 83
  intestinovesical, 597
Follicularis and cystitis glandularis, 198
Forceps, obstetric, 780
Foreign bodies in hand, 508
Funnel sternum, surgery of, 144

Gallbladder
  adenocarcinoma of, 248
  torsion of, 749
Gastrectomy
  partial, for duodenal ulcer, 163
  subtotal, for carcinoma, 5
Gastroenterostomy, indication for, 81
Gastroileostomy, a surgical error, 191
Gastrointestinal tract, carcinoid tumors of, 372
Gelfoam
  and gastrointestinal hemorrhage, 230
  in intestinal anastomosis, 462
Goiter
  nodular, 202
  true posterior mediastinal, 283
Grafting, free skin, 396
Granuloma, eosinophilic, of rib, 402

Halsted—teacher of surgeons, 122
Hand
  blast wounds of, 219
  foreign bodies in, 508
Hemangioma, cavernous, of mesentery, 293
Hemipelvectomy for tumors of bone, 27
Hemorrhage
  upper gastrointestinal, 230
  vaginal, and potassium permanganate, 227
Hemorrhoids, role of posture in, 626
Hepatectomy, partial, and intrahepatic cholangiojejunostomy, 746
Hepatoma treated with excision, 295
Hernia
  inguinal, 474
  lumbar, 766
  massive ventral, 466
  spigelian, 103
Herniation of rectum, 288
Hip nailing, 772
Hormones and female genital cancer, 149
Hypertension
  portal, 727
    correction of, 58
Hypertrophy, lipomatous, of ileocecal valve, 533
Hypospadias and undescended testicle, 8
Hysterectomy
  total, with resection of bowel, 578
  vaginal, 498

Ichthyosis, congenital, 236
Ilium, tumor of, 754
Infections, deep neck, 213
Injection, procaine (E.), 413
Intestine
  polyps of, 390
  small, perforation of, 771
Intussusception, irreducible gangrenous, 526

Jejunostomy feeding, polyethylene catheter in, 408

Knott technic in septic abortions, 736
Kutapressin in Raynaud's and Buerger's diseases, 448

Labor, dilute posterior pituitary extract in, 76
Light, sterile, in operative field, 412
Lipomatosis, familial multiple, 762
Liver
  cyst in ligamentum teres of, 531
  metastases to, 287
Lymphoma, benign, of rectum, 611

Malignancies, multiple, primary (E.), 303
Manchester operation for uterine prolapse, 156
Mastectomy, radical, for carcinoma of breast, 185
Mastoid infections, antibiotics and chemotherapy in, 334
Medical education and finances (E.), 183
Melanoma, anorectal malignant, 709
Melanosis coli, 631
Mesentery, hemangioma of, 293
Metastases, liver, and carcinoma of colon, 287
Meyerding bone skid, 411

Neck
  infections of, 213
  tumors and cysts of, 93

Neurilemomas, malignant, of peripheral nerves, 416
Neurofibroma, presacral, 405
Nipple, discharge from, 209
Nuck's canal, papillary cystadenoma of, 769

Obstetric Clinics
  Cesarean section, 263
  Ectopic pregnancy, 485
Oophorectomy, prophylactic, with resection of bowel, 571

Pain
  intractable, in peripheral vascular diseases, 260
  perineal, 251
  significance of, in carcinoma of breast, 733
Pancreas
  biopsy of, 451
  tumor of, 754
Parathyroid adenoma, 439
Perforation
  impalement, of perineum, 511
  of small intestine, 771
Perineum, perforations of, 511
Peripheral nerves, neurilemomas of, 416
Pituitary extract in labor, 76
Polyethylene
  catheter for jejunostomy feeding, 408
  tubing in salpingoplasty, 280
Polyps of large intestine, 390
Portal hypertension, correction of, 58
Potassium permanganate and vaginal hemorrhage, 227
Pregnancy
  abdominal, 365
  ectopic, 432, 485
Procaine injection therapy (E.), 413
Proctalgia fugax, 616
Proctology, new horizons in, 542
Prolapse, uterine, colporrhaphy for, 156
Prostatectomy
  prevesical, 152
  rationale of, 714
Prosthesis, temporary, for amputation, 778
Pruritus ani
  amino acid therapy for, 557
  surgical management of, 560

Radiography, stereoscopic, in diagnosis of anorectal fistula, 83
Raynaud's disease, kutapressin in, 448
Rectum
  adenoma of, 546
  anomaly of, 538
  complications of, after genitourinary cancer, 645
  congenital anomalies of, in infants, 651
  herniation of, 288
  lymphoma of, 611
Rectum, sarcoma of, 709
Rib, eosinophilic granuloma of, 402
Rucker method of episiotomy repair, 251
Rupture of uterus, 354

Salpingoplasty with polyethylene tubing, 280
Sarcoma, rectal, 709
Screw fixation, failures in, 55
Shunt, splenorenal, for portal hypertension, 727
Sigmoid
  adenoma of, 546
  colon, congenital anomalies of, in infants, 651
  diverticula, acute perforation of, 349
Sinus infections, antibiotics and chemotherapy in, 334
Sixtieth anniversary (E.), 1
Skin
  grafting, open method of, 396
  human, rate of healing of, 720
Spigelian hernia, 103
Splenic vein, surgical anatomy of, 339
Stellate ganglion block, 344
Sterile light, in operative field, 412
Sternum, funnel, 144
Streptomycin in anorectal tuberculosis, 564
Surgery
  cardiac arrest during, 683
  fifty years ago, 111
  of biliary tract, 458
  of funnel sternum, 144
  of trauma, 18
  reparative tubal, poor results of, 278
Suture tie box, 510

Tendon, avulsion of, 290
Testicle, undescended, and hypospadias, 8
Thrombin and gastrointestinal hemorrhage, 230
Thyroid, carcinoma of, and nodular goiter, 202
Thyroidectomy, hemostatic control in, 273
Thyroiditis, 381
  chronic non-specific, 71
Tibia, angulation of, 98
Tissue displacement in stellate block, 344
Torsion, acute, of gallbladder, 749
Trauma
  abdominal, non-penetrating, 771
  prevention of, to bile ducts, 132
  romance of, 18
Tube
  decompression, length of, 697
  fallopian, rapidity of healing, 278
Tuberculosis, anorectal, streptomycin in, 564
Tubing, polyethylene, 280
Tumors
  carcinoid, of gastrointestinal tract, 372
  giant cell, of ilium, 754
  islet cell, of pancreas, 754

Tumors, of bone, hemipelvectomy for, 27
of neck, 93
of uterine canal, test for, 240

Ulcer, duodenal, partial gastrectomy for, 163

Ultraviolet blood irradiation in septic abortions, 736
Urethra, diverticulum of, 360
Urinary tract, lower, anomaly of, 538
Uterine canal, tumors of, 240
Uterus, rupture of, 354

Wound
healing, human fallopian tube, 278
of hand, 219

# The American Journal of Surgery

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VOLUME LXXXII

JULY TO DECEMBER

1951

THE AMERICAN JOURNAL OF SURGERY, INC.

49 WEST 45TH STREET, NEW YORK 36, N. Y.

MCMLI

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# CONTENTS OF VOLUME LXXXII

## ORIGINAL ARTICLES


| | | |
|---|---|---|
| Sixtieth Anniversary | *T. S. W.* | 1 |
| Local Recurrence Following Subtotal Gastrectomy for Carcinoma | *Clarence J. Berne.*<br>*Marshall A. Freedman* | 5 |
| Undescended Testicle and Hypospadias | *Meredith Campbell* | 8 |
| The Romance of Trauma. The Development of the Surgery of Trauma | *Isidore Cohn* | 18 |
| Hemipelvectomy for Tumors of Bone. Report of Fourteen Cases | *Bradley L. Coley*<br>*Norman L. Higinbotham.*<br>*Claude Romieu* | 27 |
| Operative Approaches to the Ankle Joint | *Paul C. Colonna*<br>*Edgar L. Ralston* | 44 |
| Failures in Screw Fixation | *Herbert C. Fett*<br>*Champe C. Pool*<br>*Samuel C. E. Clayton* | 55 |
| Experiences with the Operative Correction of Portal Hypertension | *Frank Gerbode.*<br>*Emile Holman* | 58 |
| Chronic Non-specific Thyroiditis | *Emil Goetsch* | 71 |
| Intravenous Use of Dilute Posterior Pituitary Extract during Labor | *Charles A. Gordon* | 76 |
| Indication for Gastroenterostomy | *Donald Guthrie* | 81 |
| Stereoscopic Radiography in the Diagnosis of Anorectal Fistula | *Louis J. Hirschman* | 83 |
| Carcinoma of the Male Breast | *Claude J. Hunt*<br>*Jacob Kraft* | 86 |
| Tumors and Cysts of the Neck | *Arnold S. Jackson* | 93 |
| Congenital Posterior Angulation of the Tibia. A Clinical Entity Unrelated to Congenital Pseudarthrosis | *Arthur Krida* | 98 |
| Spigelian Hernia | *E. Eric Larson* | 103 |
| The Lost Art of Clinical Diagnosis | *Urban Maes* | 107 |
| Surgical Operations Fifty Years Ago | *Rudolph Matas* | 111 |
| Halsted—Teacher of Surgeons | *Roy D. McClure*<br>*D. Emerick Szilagyi* | 122 |
| Prevention of Traumatic Injury to the Bile Ducts. A Study of the Structures of the Cystohepatic Angle Encountered in Cholecystectomy and Supraduodenal Choledochostomy | *Darvan A. Moosman.*<br>*Frederick A. Coller* | 132 |
| Surgical Treatment of Funnel Sternum | *Gordon Murray* | 144 |
| Relation of Hormones to Female Genital Cancer | *Emil Novak* | 149 |
| Prevesical Prostatectomy | *C. R. O'Crowley*<br>*Anthony R. Fernicola* | 152 |
| Manchester Operation of Colporrhaphy in the Treatment of Uterine Prolapse | *Louis E. Phaneuf.* | 156 |
| Duodenostomy. Technic for Management of Duodenal Stump in Certain Cases of Partial Gastrectomy for Duodenal Ulcer | *James T. Priestley*<br>*Donald B. Butler* | 163 |
| Tragic Effects of Delay on the Resectability and Survival Rate of Carcinoma of the Colon | *R. L. Sanders* | 167 |

| | | |
|---|---|---|
| Radical Operation for Carcinoma of the External Auditory Canal and Middle Ear | *Grant E. Ward*<br>*Walter E. Loch*<br>*Walter Lawrence, Jr.* | 169 |
| Débridement | *John Homer Woolsey* | 179 |
| Medical Education and Finances | *T. S. W.* | 183 |
| Carcinoma of the Breast. Five- to Twenty-year Follow-up Following Radical Mastectomy | *Eugene E. Cliffton*<br>*Louis E. Young* | 185 |
| Surgical Error of Gastroileostomy. Report of Six Cases | *Arthur G. Michels*<br>*Charles H. Brown*<br>*George Crile, Jr.* | 191 |
| Cystitis Glandularis and Follicularis | *Herman L. Kretschmer* | 198 |
| Nodular Goiter and Carcinoma of the Thyroid | *Edwin R. Fisher*<br>*Bernard Fisher* | 202 |
| Discharge from the Nipple | *James G. Garland* | 209 |
| Deep Neck Infections | *Louis F. Knoepp* | 213 |
| Small Caliber Missile Blast Wounds of the Hand. Mechanism and Early Management | *Ronald W. Adams* | 219 |
| Vaginal Hemorrhage Due to Potassium Permanganate | *Samuel Lubin*<br>*Richard Waltman* | 227 |
| Gelfoam and Thrombin in Treatment of Massive Upper Gastrointestinal Hemorrhage | *Meyer O. Cantor*<br>*Charles S. Kennedy*<br>*Roland P. Reynolds* | 230 |
| Congenital Ichthyosis | *H. P. Lattuada*<br>*M. S. Parker* | 236 |
| Diagnostic Test for Tumors of the Uterine Canal | *W. B. Norment* | 240 |
| Primary Adenocarcinoma of the Gallbladder with Intramural Calcification | *Robert H. Kazmierski* | 248 |
| Evaluation of the Rucker Method of Episiotomy Repair As to Perineal Pain | *Theodore E. Mandy*<br>*Stuart M. Christbilf, Jr.*<br>*Arthur J. Mandy*<br>*Isadore A. Siegel* | 251 |
| Recovery from Prolonged Cardiac Arrest | *Harry S. Ivory*<br>*Harvey Rinzler* | 256 |
| Management of Intractable Pain in Peripheral Vascular Diseases | *Joseph H. Siris*<br>*Jacob W. Kahn* | 260 |
| Cesarean Section | *Charles A. Gordon*<br>*Alexander H. Rosenthal*<br>*James L. O'Leary* | 263 |
| Hemostatic Control in Thyroidectomy | *Joseph E. Bellas* | 273 |
| New Method of Postoperative Anorectal Analgesia | *Sidney Krohn*<br>*John B. Spriggs*<br>*C. Harwell Dabbs* | 275 |
| Rapidity of Human Fallopian Tube Wound Healing As Cause for Poor Results from Reparative Tubal Surgery. A Preliminary Report | *Abner I. Weisman* | 278 |
| Salpingoplasty Using Polyethylene Tubing. A Preliminary Report | *David J. Wexler*<br>*Charles H. Birnberg*<br>*Anthony Kohn* | 280 |
| True Posterior Mediastinal Goiter | *Nathan N. Crohn*<br>*Mathew W. Kobak* | 283 |

| | | |
|---|---|---|
| Carcinoma of the Colon with Metastases to the Liver | *William B. Rawls*<br>*V. Charles Ancona* | 287 |
| Herniation of the Rectum Following Coccygectomy | *J. E. McClenahan*<br>*Bernard Fisher* | 288 |
| Traumatic Avulsion of Tendon of Insertion of Biceps Brachii | *Harold G. Lee* | 290 |
| Giant Cavernous Hemangioma of the Mesentery | *Conde F. Conroy*<br>*Tokuso Taniguchi* | 293 |
| Hepatoma in Five Year Old Child Treated with Excision | *Ward O'Sullivan* | 295 |
| Spontaneous Expulsion per Anum of Sequestrated Transverse Colon | *Roald N. Grant*<br>*Lemuel Bowden* | 299 |
| Multiple Primary Malignancies | *Hymen D. Stein*<br>*Albert Behrend* | 303 |
| Studies in Wartime Anesthesia | *Richard Foregger* | 306 |
| Enlargement of the Male Breast in Naval Personnel | *Norman Lenson* | 325 |
| Consideration of Acute Cholecystitis. An Analysis of Seventy-six Cases | *Hugh A. Bailey*<br>*Lawrence B. Thrush* | 328 |
| Use of Antibiotics and Chemotherapy in Sinus and Mastoid Infections | *Anchise A. Cirillo* | 334 |
| Surgical Anatomy of the Splenic Vein | *Aaron B. Gerber*<br>*Maurice Lev*<br>*Samuel L. Goldberg* | 339 |
| Stellate Ganglion Block. The Tissue Displacement Method | *Donald W. Smith* | 344 |
| Surgical Management of Acute (Sudden) Perforation of Sigmoid Diverticula | *LeRoy Jay Hyman*<br>*Samuel O. Freedlander* | 349 |
| Rupture of the Uterus | *Joseph Patrick Donnelly* | 354 |
| Urethral Diverticulum in Women | *Maurice Rashbaum* | 360 |
| Abdominal Pregnancy | *Arthur S. MacGregor* | 365 |
| Carcinoid Tumors of the Gastrointestinal Tract | *Kenneth W. Warren*<br>*Capt. Edwin B. Coyle* | 372 |
| Fate of Frozen Homogeneous Bone Transplants | *Albert G. Marrangoni* | 378 |
| Thyroiditis | *Leonard K. Stalker*<br>*Charles D. Walther* | 381 |
| Polyps of the Large Intestine | *S. W. Moore* | 390 |
| Open Method of Free Skin Grafting | *John A. Jenney* | 396 |
| Solitary Eosinophilic Granuloma of Rib | *Robert T. Fox*<br>*James Carswell, Jr.* | 402 |
| Presacral Neurofibroma | *Mark E. Gann*<br>*Elmer Hoffman* | 405 |
| Use of the Polyethylene Catheter for Jejunostomy Feeding | *Francis C. Usher* | 408 |
| Description of the Meyerding Hip and Shoulder Bone Skid | *Henry W. Meyerding* | 411 |
| Sterile Light for Attachment in the Operative Field | *Kenneth J. Strully* | 412 |
| Procaine Injection Therapy of Painful Conditions. Selection of Patients | *Ralph Gorrell* | 413 |
| Malignant Neurilemomas of Peripheral Nerves | *John O. Vieta*<br>*George T. Pack* | 416 |

| | | |
|---|---|---|
| Diagnosis and Management of Ectopic Pregnancy | *Edward N. Bookrajian*<br>*Charles Luther* | 432 |
| Parathyroid Adenoma | *Claude C. Blackwell* | 439 |
| Experimental Therapy of Raynaud's and Buerger's Diseases with Kutapressin | *Wallace Marshall* | 448 |
| Safe Method of Pancreatic Biopsy. A Preliminary Report | *Howard B. Kirtland, Jr.* | 451 |
| Biliary Tract Surgery | *Urban Maes*<br>*Gerald N. Weiss* | 458 |
| Effect of Gelfoam on the Integrity of Intestinal Anastomosis | *B. E. Chamberlain*<br>*J. E. Delmonico, Jr.*<br>*R. O. Gregg* | 462 |
| Fascia Lata Repair of Massive Ventral Hernias | *Robert C. Austin*<br>*Eugene F. Damstra* | 466 |
| Inguinal Hernias. Some Causes of Recurrence | *Amos R. Koontz* | 474 |
| Amputation of Lower Extremities in the Aged | *Howard M. Kern* | 479 |
| Ectopic Pregnancy | *Charles A. Gordon*<br>*Alexander H. Rosenthal*<br>*James L. O'Leary* | 485 |
| Effect of Bacitracin Suppositories on the Vaginal Flora and on Morbidity in Vaginal Hysterectomies | *S. J. Turner*<br>*M. N. Wacker*<br>*M. Goldin*<br>*Helen Auerbach* | 498 |
| Preoperative Use of the Compressive Bandage in Treatment of Venous Insufficiency in the Lower Extremities | *Peter J. Kesseler* | 504 |
| Simple Method of Localizing Foreign Bodies in the Hand | *David A. Willis* | 508 |
| Suture Tie Box | *Walter G. Maddock* | 510 |
| Impalement Perforations of the Perineum | *Paul F. Fox* | 511 |
| Neurogenic Ossifying Fibromyopathies | *H. C. Fett*<br>*J. G. Yost* | 517 |
| Dissecting Aneurysm Simulating Large Bowel Obstruction | *Henry W. Mayo, Jr.* | 522 |
| Irreducible Gangrenous Intussusception | *Victor E. Tedesco* | 526 |
| Cyst in the Ligamentum Teres of the Liver. Remnant of the Umbilical Vein | *John E. Karabin* | 531 |
| Lipomatous Hypertrophy of the Ileocecal Valve | *Monte Edwards*<br>*Henry Zangara* | 533 |
| Rare Anomaly of the Rectum and Lower Urinary Tract | *Francis J. Burns*<br>*LeRoy J. Stephens*<br>*Helmuth H. Kramolowsky* | 538 |
| New Horizons in Proctology. The Third Joseph McDowell Mathews Memorial Oration | *Frank C. Yeomans* | 542 |
| Adenoma of the Rectum and Lower Portion of the Sigmoid. A Clinicopathologic Study | *Wilford L. Cooper*<br>*Louis A. Buie*<br>*John R. McDonald* | 546 |
| Maximal Diagnostic Potential of Barium Enema in the Management of Colon Disease | *James A. Ferguson* | 553 |
| Amino Acid Therapy for Pruritus Ani | *Laurence G. Bodkin* | 557 |
| Surgical Management of Idiopathic Pruritus Ani | *Guy L. Kratzer* | 560 |

| | | |
|---|---|---|
| Streptomycin in the Treatment of Anorectal Tuberculosis. With Particular Reference to Topical Therapy | *Isaac Skir*<br>*Norman L. Freund*<br>*Joseph M. Gross* | 564 |
| Prophylactic Oophorectomy with Resection of the Large Bowel for Cancer | *Con Amore V. Burt* | 571 |
| Total Hysterectomy with Resection of Primary Carcinoma of the Bowel. A Report of Forty-seven Cases | *Richard B. Cattell*<br>*Albert J. Mace* | 578 |
| Diverticulosis and Diverticulitis. General Consideration and Sigmoidoscopic Diagnosis | *Newton D. Smith* | 583 |
| Roentgenologic Aspects of Diverticulitis and Its Complications | *Russell Wigh*<br>*Paul Swenson* | 587 |
| Intestinovesical Fistula | *George H. Ewell* | 597 |
| Surgical Aspects of Diverticulitis | *Neil W. Swinton* | 603 |
| Benign Lymphoma of the Rectum | *B. F. Sniderman* | 611 |
| Proctalgia Fugax | *Joseph D. Karras*<br>*Gaspar Angelo* | 616 |
| Role of the Arteries and of Posture in Hemorrhoids | *Victor C. Tucker* | 626 |
| Melanosis Coli. Experimental Observations on Its Production and Elimination in Twenty-three Cases | *George S. Speare* | 631 |
| Consideration of the Newer Antibiotics | *Wallace E. Herrell* | 638 |
| Rectal Complications Following Treatment of Genitourinary Cancer | *Orville T. Evans* | 645 |
| Congenital Anomalies of the Anus, Rectum and Sigmoid Colon and Their Surgical Management in Infants | *William J. Eckerle* | 651 |
| Unusual Foreign Body in the Colon | *George I. Israel* | 657 |
| Significance of the Anal Gland | *Ralph M. Burke*<br>*Dan Zavela*<br>*Donald H. Kaump* | 659 |
| Scientific Round Table Discussion | | 663 |
| Blood Vessel Bank for the Reconstruction and Repair of Biliary Ducts | *A. L. Soresi* | 671 |
| Management of Diverticulitis Coli | *Hollis L. Albright*<br>*Field C. Leonard* | 674 |
| Cardiac Arrest during Surgery | *Meyer Corff* | 683 |
| Agenesis of the Vermiform Appendix | *Donald C. Collins* | 689 |
| Effect of Variation in Length of Decompression Tube upon Bowel Wall. A Clinical and Laboratory Study | *Meyer O. Cantor*<br>*Earle Acker*<br>*Andrew Scharf*<br>*Keith Foster* | 697 |
| Acute Cholecystitis. Study of 140 Cases | *H. Robert Freund* | 703 |
| Rectal Sarcoma and Anorectal Malignant Melanoma | *Harry C. Bacon*<br>*Michael C. Tavenner* | 709 |
| Rationale of Prostatectomy | *Miley B. Wesson* | 714 |
| Further Studies of the Rate of Healing of Human Skin Measured by the Electrical Wound Potential of Experimental Abrasions | *T. Cunliffe Barnes*<br>*J. Karasic*<br>*Marie D. Amoroso* | 720 |
| Splenorenal Shunt for Portal Hypertension. Thoracicoabdominal Approach | *Conrad R. Lam* | 727 |

| | | |
|---|---|---|
| Carcinoma of the Breast. The Diagnostic Significance of Pain | *Louis River, Joseph Silverstein, John Grout, Everett Nicholas, Arne Schairer, Berger Carlson, Roy Tanoue, John Tope* | 733 |
| Further Studies with Ultraviolet Blood Irradiation Therapy (Knott Technic) in Septic Abortions | *E. W. Rebbeck* | 736 |
| Breast Biopsies. A Study of over 400 Cases | *Lawrence G. Khedroo, Philip A. Casella, Arthur F. Cipolla* | 741 |
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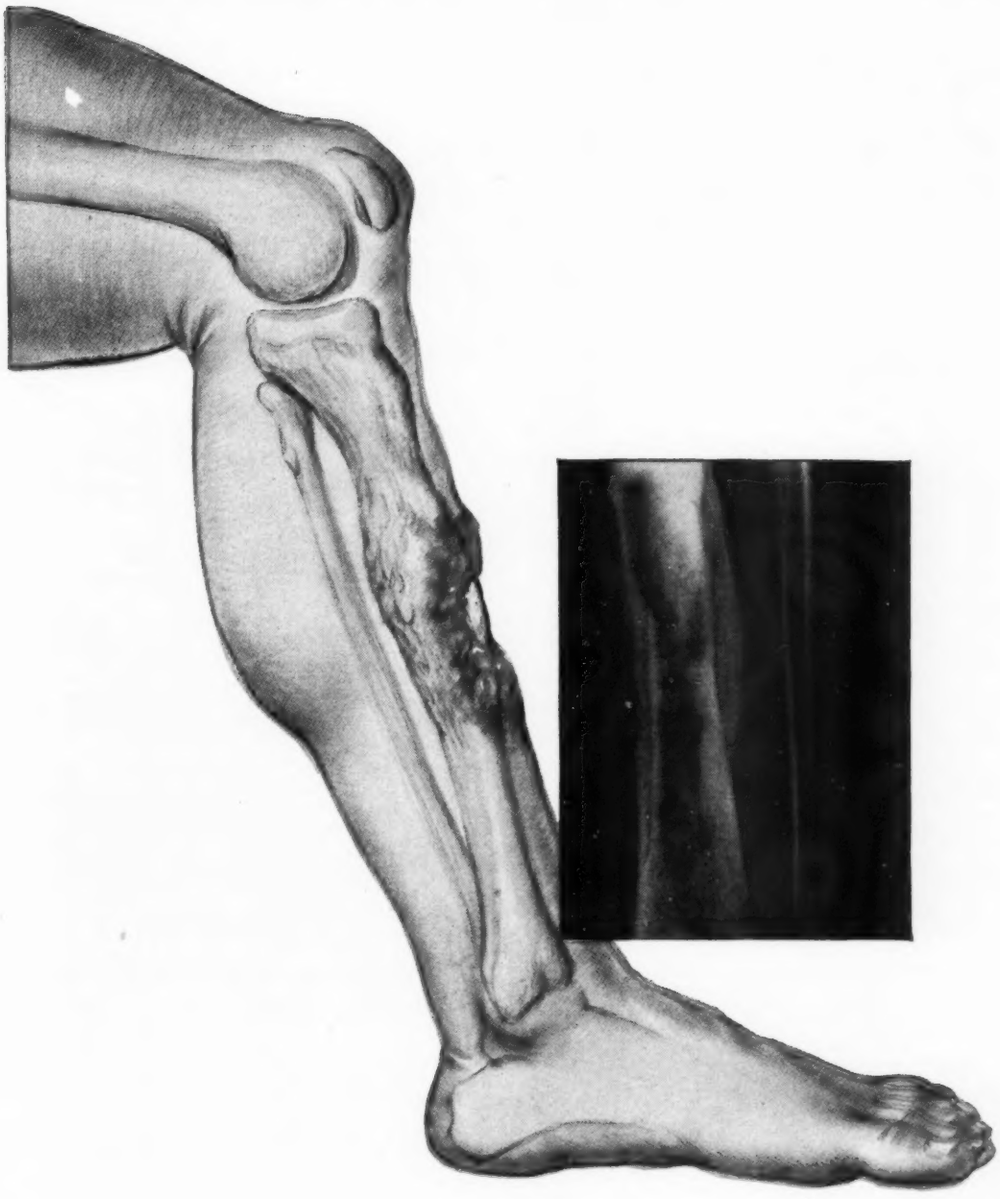

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2. Turell, R.: New York St. J.M. 50:2282, 1950.
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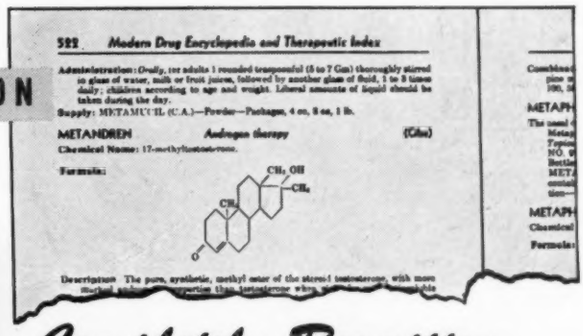
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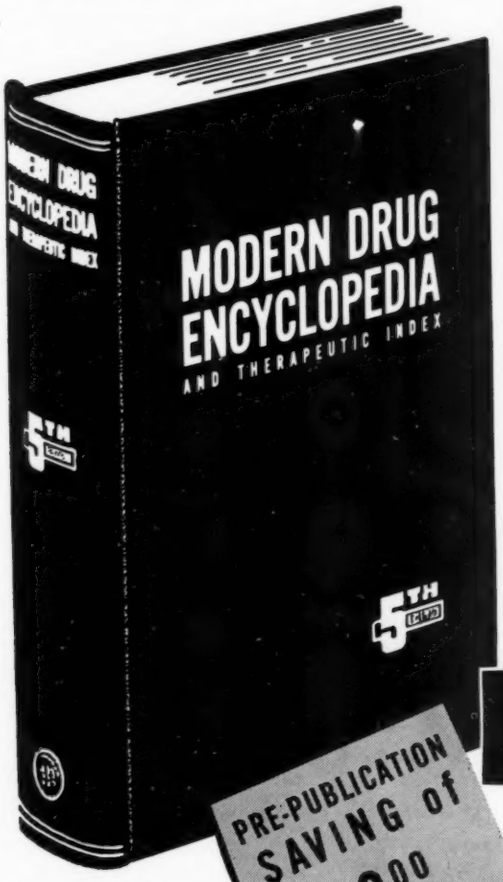


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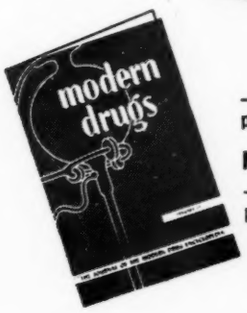


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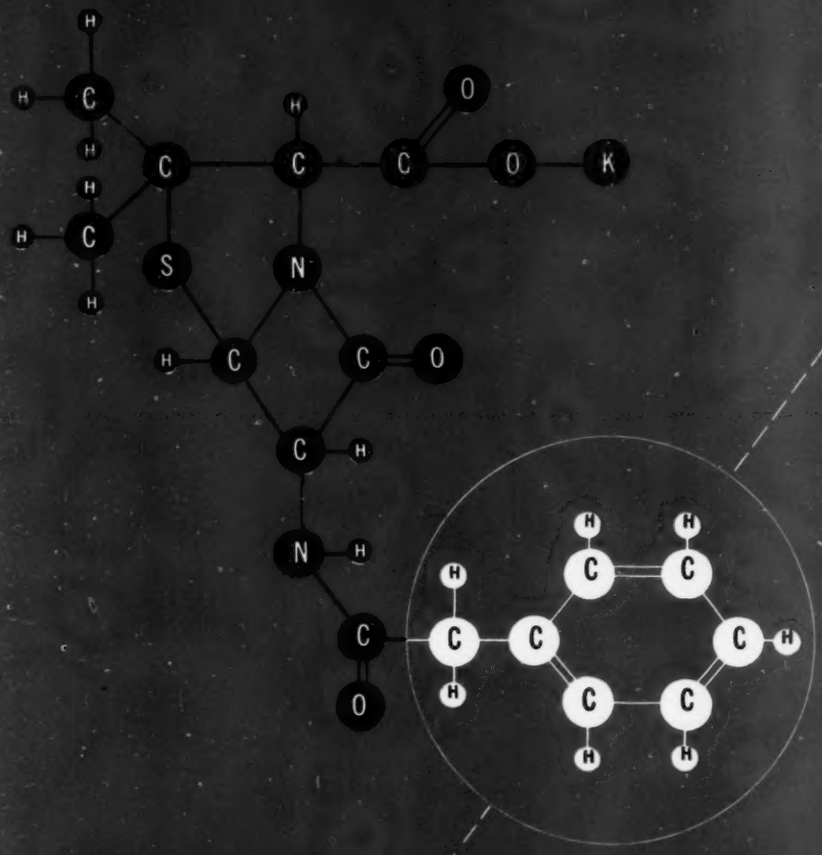

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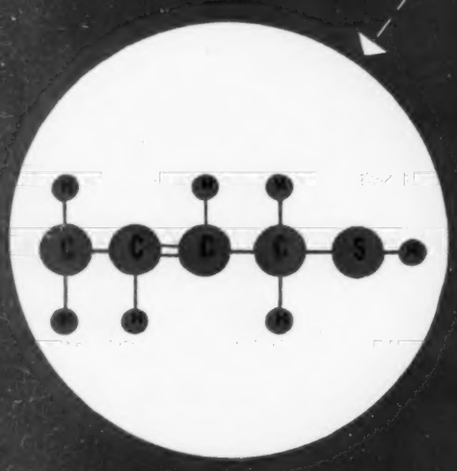

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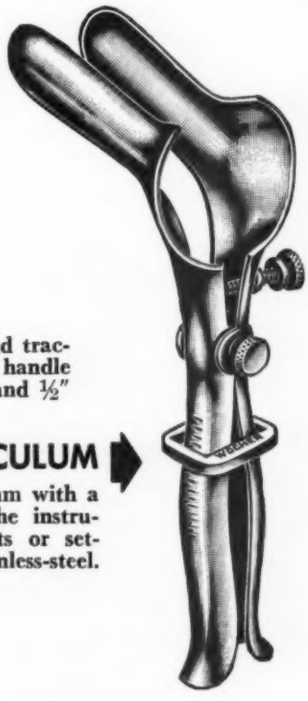


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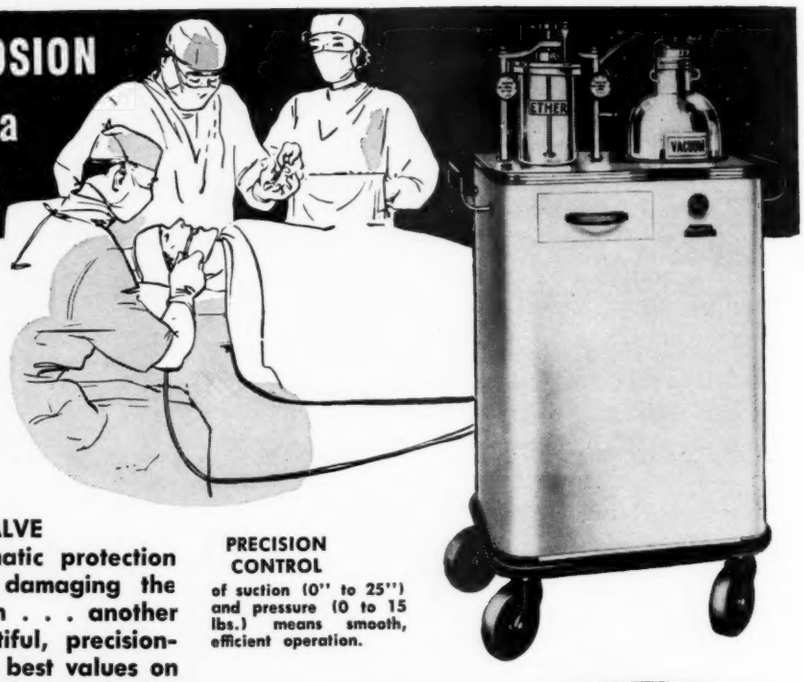


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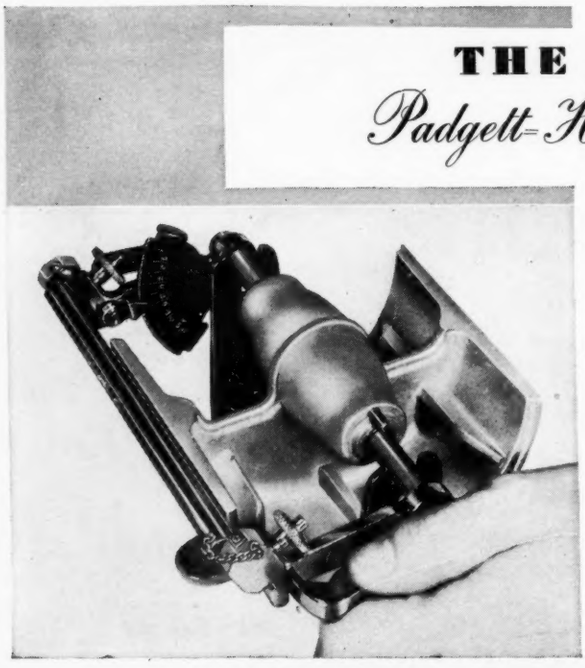

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# Outside the Ivory Tower

IT would seem that there are two simple ways to lessen the hazard of becoming a statistical digit in the total of some 250 Americans who intercept a lethal bolt of lightning each year. One way is to move to Rhode Island. Another is to move from the country to the city, preferably to take residence in a steel-framed building. These suggestions stem from a report by Metropolitan Life Insurance Company statisticians that little Rhode Island has had no deaths from lightning since 1936, and that about nine of ten fatalities from this cause occur in places with 2,500 or fewer inhabitants. City dwellers are relatively free from danger, the Metropolitan's safety experts advise, because the steel of the tall buildings acts as a lightning conductor, and because the urbanite usually does not have far to go to reach a place of shelter when caught in a sudden thunderstorm.

A TEAM of military and civilian experts who spent a month in Japan and Korea studying frostbite cases have recommended improved methods of treating this type of injury, the Department of the Army announced. Principal methods suggested for treating frostbite include rest in bed and no smoking for all patients, daily foot care with a mild, non-irritating cleansing agent, a hospital ward temperature maintained between 72 and 78 degrees, the use of penicillin during evacuation for treatment and employment of other antibiotics during treatment, and the delay of surgery until there is no question of demarcation of the affected part.

A REVISED guide for physicians in measuring human blood pressure has been issued by the American Heart Association. The guide, entitled "Recommendations for Human Blood Pressure Determinations by Sphygmomanometer," was published simultaneously in the October issue of *Circulation*, the Journal of the American Heart Association, and the October 13th issue of the *Journal of the American Medical Association*. It will shortly be available to physicians in booklet form through application to affiliated heart associations or to the American Heart Association's National Office, 1775 Broadway, New York 19. The "Recommendations" replace the booklet "Standardization of Blood Pressure Readings" originally published by the Association in 1939. The revisions were drawn up by a committee appointed by the Council for High Blood Pressure Research of the American Heart Association, under the Chairmanship of Dr. Carl J. Wiggers, Professor of Physiology at Western Reserve University School of Medicine, Cleveland.

In commenting on the publication of the "Recommendations," Dr. Wiggers said: "The physician, and through him nurses and properly trained technicians, are being constantly kept informed of new discoveries which help to make blood pressure readings more accurate. The measurement of human blood pressure is still a comparatively new tool, the introduction of which is well within the memory of many of the older groups of practitioners. Recognizing that physicians were employing different technics and criteria in measuring blood pressure, and too generally assumed that instruments sold were accurate, the American Heart Association in 1939 appointed a committee to crystallize the best available thought on the subject at that time by publishing a pamphlet entitled 'Standardization of Blood Pressure Readings.' This has resulted in more precise standardization of methods and has stimulated manufacturers to make improvements in apparatus.

"Since that time, more experience has been gained in laboratories and hospitals, resulting in even greater accuracy in measurement of human blood pressure. This has now been assembled in the new 'Recommendations.'"

RESEARCHERS of the Communicable Disease Center, Public Health Service, have isolated the virus of encephalitis from wild birds under natural conditions, it was announced by Leonard A. Scheele, Surgeon General of the Public Health Service, Federal Security Agency. It has been suspected for many years that birds harbor the virus, but this is the first time that their role definitely has been proven, according to Dr. T. Aidan Cockburn, epidemiologist in charge of encephalitis studies, Office of Midwestern CDC Services, Kansas City, Kan. CDC headquarters are in Atlanta, Ga. The encephalitis unit at Greeley, Colo., under Dr. Cockburn's direction, has reported the isolation of virus twice from redwing blackbirds and once from magpies.

(*continued on page* 44)

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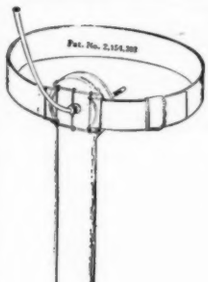

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# Outside the Ivory Tower

(*continued from page 42*)

THE Department of Defense is planning a concerted effort to replenish its "gravely depleted" supply of human blood plasma. The depletion of the Armed Forces' plasma reserve is due primarily to the extensive use of plasma in Korea where its use in forward areas had kept many of the wounded alive until they could be evacuated to an area in which whole blood was available. The use of plasma and whole blood in Korea is a major factor in the reduction of the mortality rate among wounded. The decline in this rate is most easily expressed in the number of men per 100 who died after reaching the most forward surgical hospital. In World War I eight to eleven per 100 died. In World War II the number was reduced to 4.5 and in the Korean conflict it is 2.6 men per 100.

Field installations of the Army, Navy, Air Force and Marine Corps have been instructed to cooperate with the Red Cross to the fullest possible extent to raise the level of available plasma reserves. All commands have been directed to wage a continuous and vigorous campaign in conjunction with the Red Cross to persuade the civilian and military population to contribute whole blood to the Armed Forces. The military services are also establishing an Armed Forces blood donor program within the framework of the over-all campaign, the primary purpose of which is to obtain blood from service personnel and civilian employees on military bases within the continental United States. The value of a reserve supply of plasma has been proved in Korea, yet it is one vital commodity that assembly lines cannot produce and money cannot buy. Plasma, a blood derivative obtained by separating red cells from human blood, has never been synthesized. It is manufactured only in the human body.

To assure each soldier, sailor, airman and marine an adequate reserve of this vital fluid for use when and where he needs it, the Department of Defense has financed the expansion of blood processing laboratories, and asked the Red Cross to collect for the Defense Department nearly three million pints of whole blood, to be processed into more than a million plasma units between July 1, 1951, and July 1, 1952. This means that 270,000 pints per month must be collected during this fiscal year for the Defense Department plasma reserve. Ups and downs in the Korean campaign have had a noticeable effect on the amount of whole blood the Red Cross collected. When the going has been tough in Korea, collections have been good. Conversely, when the United Nations has had the upper hand, collections have been well below normal. Indicative of this is the fact that since the Kaesong cease-fire negotiations began, collections have dropped to one-third of the requirement.

FOR the first time in European medical history, medical television will be taken on a tour of Europe, so that surgeons and physicians may view televised surgical operations and clinical procedures conducted by leading members of their profession during September and October. As a result of a joint arrangement between E. R. Squibb & Sons International Corporation and RCA, surgical demonstrations and educational programs will be conducted in six European countries to illustrate the training advantages of the science of television. This large scale project, named "Video Medico," which in the past year was brought to nine Latin American countries, is designed to demonstrate an important advance in medical education which medical leaders expect to revolutionize the study of medicine.

DESPITE the great victories of medical science in combating premature death, life ends before age sixty-five for half of all American males and 40 per cent of all females, Metropolitan Life Insurance Company statisticians report. Each year about 360,000 men and 200,000 women die before reaching their sixty-fifth birthday. These figures include over 100,000 deaths annually among infants under one year of age, and this although the mortality rate among babies in the first year of life has been reduced by more than one-third in the last ten years.

"While there are many biological and environmental hazards which beset early life, much more can be done either to prevent or to overcome them," the statisticians observe. "The measures being taken in many communities to provide special facilities for the care of prematurely born children should prove effective in reducing further the mortality in infancy."

(*continued on page 46*)

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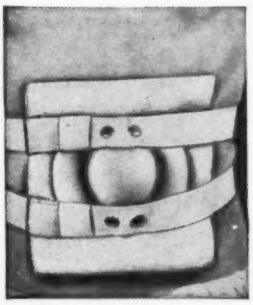

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J.A.M.A. April 21, 1951 p. 1238

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# Outside the Ivory Tower

(*continued from page 44*)

AT this writing the season's release of new books has not really started. However, a few worth while works have crossed our desk and we gladly pass the information on to you.

The Williams and Wilkins Co. of Baltimore, Md., have published the Fourth Edition of the well known and deservedly popular, "The Essentials of Modern Surgery," edited by R. M. Handfield-Jones and Sir Arthur E. Porritt. There are 1,263 pages, 644 illustrations, many of which are in color, and an index.

Of interest to orthopedic surgeons and to those who do work in this field, Blackwell Scientific Publications, Oxford, have brought out "Instruments and Apparatus in Orthopaedic Surgery," by E. J. Nangle, M.S., with a Preface by H. J. Seddon and Joseph Trueta. It is well illustrated, has references at chapter endings, 231 pages, and an author and a subject index. This book is an excellent guide for the orthopedic surgeon and will be found to be especially beneficial to those concerned with the prescription of appliances for disabled persons.

To those interested in the subject, Charles C Thomas of Springfield, Ill., has published "Micro-Arteriography—And Other Radiological Techniques Employed in Biological Research," by Alfred E. Barclay, M.D., late honorary radiologist at Nuffield Institute for Medical Research, Oxford. It contains 102 pages including references, an index and is illustrated. It is tops in its field.

If a surgical chief or attending surgeon wishes to give a book to one or more of his housemen on "Surgery of the Stomach and Duodenum" (by Claude E. Welch, M.D., Associate Visiting Surgeon, Massachusetts General Hospital; Clinical Associate in Surgery, Harvard Medical School), the Year Book Publishers, Inc., have made it possible. This handbook of operative surgery deserves all the praise one can bestow upon it. It is a practical guide and will prove of great value especially to the young surgeon. (Some of the older men can well spend some time with it.) The text of the various operative procedures are on the left hand pages and the illustrations describing the steps in the operative technic are on the right hand pages. The illustrations are above the average in that the progress of the technical part of an operation is plainly shown step by step. It consists of 349 pages, seventy-nine plates and is indexed.

A CAMPAIGN to wipe out tuberculosis will be launched this year in the Philippines with the $350,000 which the E.C.A. will allocate each year for five years for this purpose, Dr. Sixto Francisco, Chief of the TB Control Division of the Department of Health, has announced. The E.C.A. aid will come in the form of equipment, supplies and materials, will be added to existing chest clinics, mobile x-ray units and technicians to launch ten anti-TB units. Organization of ten such units each year will mean servicing of ten provinces until a total of fifty units and fifty provinces are being serviced, Dr. Francisco noted. Provinces with the highest incidence and highest TB mortality rates will be given priorities in the current campaign, he added. At the present time there are seven chest clinics operating plus three mobile x-ray units. Teams in the field have already laid the groundwork for the initial moves in the campaign.

THE American Goiter Association again offers the Van Meter Prize Award of $300 and two honorable mentions for the best essays submitted concerning original work on problems related to the thyroid gland. The award will be made at the annual meeting of the Association which will be held in St. Louis, Mo., May 1, 2 and 3, 1952, providing essays of sufficient merit are presented in competition. The competing essays may cover either clinical or research investigations, should not exceed 3,000 words in length, must be presented in English and a typewritten double-spaced copy in duplicate sent to the Corresponding Secretary, Dr. George C. Shivers, 100 East Saint Vrain Street, Colorado Springs, Colo., not later than March 1, 1952. The committee which will review the manuscripts is composed of men well qualified to judge the merits of the competing essays.

DR. Leonard A. Scheele, Surgeon General of the Public Health Service, Federal Security Agency, said recently that over 800 cases of malaria among military personnel returning from Korea have been reported by State health authorities. "Seven states alone reported over 600 new cases in a single month and most of these were contracted outside the United States," said Dr. Scheele.

(*continued on page 48*)

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# Outside the Ivory Tower

(*continued from page 46*)

THE National Federation of Obstetric-Gynecologic Societies has reconstituted itself as The American Academy of Obstetrics and Gynecology. This action was taken at the Federation meeting held on June 13, 1951, in Atlantic City in response to the long felt need for a national society for obstetricians and gynecologists based on individual and personal membership.

The following officers were elected at this meeting: President, Woodard D. Beacham, New Orleans, La.; President-Elect, Carl P. Huber, Indianapolis, Ind.; Vice-President, Louis H. Douglass, Baltimore, Md.; Treasurer, Herbert E. Schmitz, Chicago, Ill.; Secretary, Ralph A. Reis, Chicago, Ill.; Executive Board, Robert G. Craig, San Francisco, Calif.; John L. Parks, Washington, D. C.; Charles D. Kimball, Seattle, Wash.; Samuel B. Kirkwood, Winchester, Mass. and Philip F. Williams, Philadelphia, Pa.

THE New York State Society of Anesthesiologists will hold its Fifth Annual Postgraduate Assembly December 5 to 8, 1951, at the Hotel New Yorker, New York City. There will be ten scientific sessions in panel format. One panel will be presented by residents and fellows in anesthesiology discussing original investigations in which they have participated. Physicians desiring to attend may secure a registration form from the office of the society at 137 West 11th Street, New York.

THE American Urological Association offers an annual award of $1000 (first prize of $500, second prize $300 and third prize $200) for essays on the result of some clinical or laboratory research in urology. Competition shall be limited to urologists who have been in such specific practice for not more than five years and to men in training to become urologists. The first prize essay will appear on the program of the forthcoming meeting of the American Urological Association, to be held at the Chalfonte-Haddon Hall, Atlantic City, N. J., June 23 to 26, 1952. For full particulars write the Secretary, Dr. Charles H. de T. Shivers, Boardwalk National Arcade Building, Atlantic City, N. J. Essays must be in his hands before February 15, 1952.

A MYRIAD of uses of papain, the protein-digesting enzyme obtained from the tropical papaw or carica papaya fruit, are reported in a monograph just published by the New York Academy of Sciences, which brings together for the first time the results of world-wide investigation of the therapeutic values of papain. Roy Waldo Miner of the Academy is editor of the monograph, and Dr. Maurice L. Tainter, director of the Sterling-Winthrop Research Institute, is consulting editor. The monograph details the intensified scientific search since 1874 to determine the properties of the substance which has been used for centuries by tropical natives to prevent dyspepsia, to treat wounds and infections, to tenderize meat and for many other purposes. The monograph contains a review of the literature on present and potential therapeutic significance of papain, prepared by Drs. Kao Hwang and A. C. Ivy of the department of clinical science, University of Illinois. It is a comprehensive report citing 338 separate investigations.

UNDER the editorship of David J. Sandweiss, M.D., and an editorial committee of twelve outstanding scientists, W. B. Saunders Co., Philadelphia, has published an exceptional work, the contributions of seventy-seven authorities, on "Peptic Ulcer," Diagnosis and Management. It is one of the Post-Graduate Medical and Surgical Series and has the imprint of the American Gastroenterological Association. The book represents one of the first efforts on the part of a national association of specialists to sponsor and produce a comprehensive but concise work dealing with an important and common disease. It contains 790 pages, is illustrated, has ample references at the chapter endings, an index eighty-three pages long and an author index. Until new work and discoveries have been accomplished, this work represents the latest from every angle on this subject.

THE child cerebral palsy victim in Wisconsin is going to have a special home at the University of Wisconsin through regent action. The regents approved the creation of an Easter Seal Cerebral Palsy Center, set up especially for the treatment of spastics. The center will operate for three years at Wisconsin General hospital with $15,000 provided each year by the Wisconsin Association for the Disabled.

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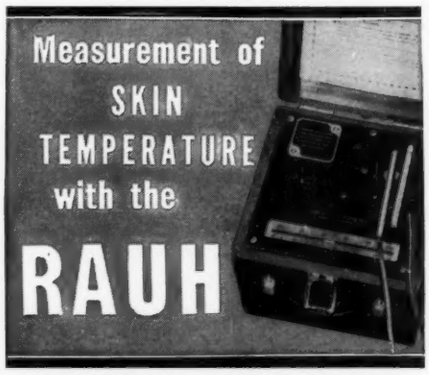


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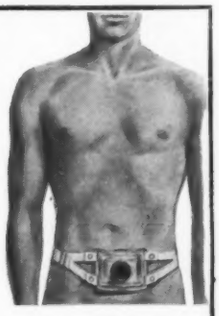

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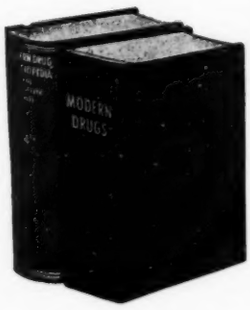


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## ADVERTISERS INDEX


### Instruments and Apparatus

American Cystoscope Makers, Inc. . . 4
C. R. Bard, Inc. . . 8
Bard-Parker Co., Inc. . . 12
Clay-Adams, Inc. . . 18–19
Crescent Surgical Sales Co. . . *November*
Gomco Surgical Mfg. Co. . . 40
Kansas City Assemblage Co. . . 40
Kny-Scheerer Corp. . . *November*
V. Mueller & Co. . . 14
Geo. P. Pilling & Son Co. . . *November*
Proper Manufacturing Co. Inc. . . *November*
Ritter Co. Inc. . . 23
The Shampaine Co. . . *November*
Sklar Manufacturing Co. . . *November*
Welch Allyn, Inc. . . *November*
Wilmot Castle Co. . . *November*
The Max Wocher & Son, Inc. . . 39

### Sutures

Davis & Geck, Inc. . . 20–21
J. A. Deknatel & Son, Inc. . . 38
Ethicon Suture Laboratories. . . *November*
Gudebrod Bros. Silk Co., Inc. . . *November*

### Pharmaceuticals

Abbott Laboratories. . . 6
American Hospital Supply Corp. . . *Insert Facing Page 8*
Ames Co., Inc. . . 1
The Armour Laboratories. . . 9
Baxter Laboratories. . . *Insert Facing Page 8*
Chatham Pharmaceuticals, Inc. . . *November*
Ciba Pharmaceutical Products, Inc. . . 29, *Back Cover*
Commercial Solvents Corp. . . 24
Cutter Laboratories. . . *November*
Desitin Chemical Co. . . 34
Dome Chemicals, Inc. . . 38
Eaton Laboratories, Inc. . . *November*
Geigy Company, Inc. . . *November*
Harvey Laboratories, Inc. . . 41
Eli Lilly and Company. . . 32
Mallinckrodt Chemical Works. . . 11
Merck & Company. . . 30
Ortho Pharmaceutical Corp. *Insert Facing Page* 24
Chas. Pfizer & Co., Inc. . . 33
Parke, Davis & Co. . . 31
A. H. Robins Co., Inc. . . *November*
Rystan Co., Inc. . . *November*
Schering Corp. . . 25
Sharp & Dohme, Inc. . . 16–17
E. R. Squibb & Sons. . . *November*
The Upjohn Co. . . 36
Winthrop-Stearns, Inc. . . 2, 27, 50
Wyeth, Inc. . . 28

### Hospital Supplies

American Hospital Supply Corp. . . *Insert Facing Page* 8
C. R. Bard, Inc. . . 8
Bard-Parker Co., Inc. . . 12
Chesebrough Mfg. Co. . . 10
Clay-Adams, Inc. . . 18–19
Cutter Laboratories. . . *November*
Johnson & Johnson. . . 13
Photocon Research Products. . . 39

### Post-Graduate Instruction

Cook County Grad. Sch. of Med. . . 37
N. Y. Polyclinic Med. School. . . 37

### Foods

American Meat Institute. . . 22
The Wander Company. . . 26

### Miscellaneous

Appleton-Century-Crofts, Inc. . . *November*
Drug Publications, Inc. . . 35
The Macmillan Co. . . *November*
Outside the Ivory Tower. . . 42, 44, 46, 48
The Surgeon's Mart. . . 43, 45, 47, 49

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